PROPOSED FINAL

BAY AREA

'94 CLEAN AIR PLAN

(and Triennial Progress Report)

Volume I

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SUMMARY

This is an update to the *Bay Area 1991 Clean Air Plan* (CAP), a plan to reduce ground-level ozone (O_3) air pollution in the San Francisco Bay Area. The '91 CAP included a comprehensive strategy to reduce air pollutant emissions. The '91 CAP focused on control measures to be implemented during the 1991 to 1994 period, and also included control measures to be implemented from 1995 through the year 2000 and beyond. This plan, called the *Bay Area 1994 Clean Air Plan,* is a continuation of the comprehensive strategy established by the '91 CAP. The '94 CAP includes changes in the organization and scheduling of some '91 CAP measures and also includes eight new proposed stationary and mobile source control measures. The '94 CAP covers the period extending from CAP adoption, expected in December of 1994, to the next California air quality planning update, expected in 1997. It also includes projections of pollutant trends and possible control activities beyond 1997.

The CAP was developed by the Bay Area Air Quality Management District, in cooperation with the Association of Bay Area Governments and the Metropolitan Transportation Commission, in response to the California Clean Air Act (CCAA) of 1988, as amended. The goals of the '94 CAP are to reduce the health impacts from ozone levels above the State ambient standard and to comply with the California Clean Air Act. The Act requires air districts that exceed the State ozone standard to reduce pollutant emissions by 5% per year, calculated from 1987, or take all feasible measures to achieve emission reductions. The Bay Area attained the State CO standard in 1993, so the CCAA planning requirements for CO nonattainment areas no longer apply to the Bay Area. The control measures proposed in the '94 CAP constitute all feasible measures for the reduction of ozone precursor emissions in the Bay Area.

Population exposure to ozone above the State standard has been cut in half since 1988. The Bay Area attained the *national* standard during the 1990-1994 timeframe and applied to EPA for formal redesignation. EPA has indicated an intent to redesignate the Bay Area by publishing a Notice of Proposed Rulemaking in the *Federal Register* on September 28, 1994. Ozone precursors--reactive organics and oxides of nitrogen--were reduced by about 3.2% per year and 1.7% per year, respectively, over the planning period 1987-1994.

For the 1994-97 period, additional ozone precursor reductions will be achieved through:

- increasingly stringent State and federal programs affecting motor vehicles, fuel and other sources;
- more stringent controls on polluting industries and businesses;
- reformulation of paints and consumer products to reduce volatile pollutant content;
- programs to reduce automobile use and traffic congestion;

- efforts to improve public transit systems and to encourage development patterns that reduce automobile dependence.

The actual measures are listed in the Proposed Control Measures and Programs section. More details are provided in Appendices F and G. Proposed regulatory schedules are shown in Table 9.

This Plan reflects the BAAQMD staff's projection of future regulatory activity. However, as "planned activities," the control measures are initial proposals subject to the rule development and workshop process, District Board consideration, ARB approval, and possibly EPA approval, prior to implementation. Accordingly, the proposals contained within the Plan may be modified and should be reviewed with this in mind.

The rule development process includes many steps, including review of control measures and adopted rules in other regions, consultation with affected parties, development of draft rules, workshops with affected and interested parties, development of technical support documentation including CEQA and socioeconomic analyses, and adoption by the BAAQMD Board of Directors at a public hearing. During this process, new information may become available regarding the availability of technology, cost, emission reduction potential, and other factors. As a result of the rule development process, the coverage, exemptions, definitions, or standards may change. Therefore, the estimated emission reductions, cost effectiveness, or scheduling of an adopted rule may be different than indicated in the control measure description in the CAP.

Ozone is not the only air quality problem in the Bay Area, but it is the pollutant of concern in this Plan. Particulate matter, toxic air pollutants, stratospheric ozone depletion, and other air quality problems are addressed through BAAQMD programs outside of this Plan.

The major benefits of the CAP will be reduced health impacts from population exposure to ozone. Additional expected benefits are reductions in: airborne particulate matter, growth of traffic congestion, energy use, global warming, crop damage, and water pollution.

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ABBREVIATIONS AND TERMINOLOGY

'94 CAP	**1994 Clean Air Plan**
AB	(California) Assembly Bill
ABAG	Association of Bay Area Governments
ARB	(California) Air Resources Board
AVR	Average vehicle ridership
BAAQMD	Bay Area Air Quality Management District
BARCT	Best Available Retrofit Control Technology
BART	Bay Area Rapid Transit District
CARB	California Air Resources Board
CCAA	California Clean Air Act (of 1988)
CCCTA	Contra Costa County Transportation Authority
CFCs	Chlorofluorocarbons
CM	Control measure
CMA	Congestion Management Agency
CMAQ	Congestion Management and Air Quality (Improvement Program)
CMP	Congestion Management Program
CO	Carbon monoxide
EBTR	Employer-based trip reduction
EPA	(United States) Environmental Protection Agency
FIP	Federal Implementation Plan
GG	Golden Gate
HC	Hydrocarbons
HOV	High-occupancy vehicle
I&M	(Motor Vehicle) Inspection & Maintenance ("Smog Check" program)
JPB	(Peninsula) Joint Powers Board
LAVTA	Livermore-Amador Valley Transit Authority
LRT	Light rail transit

MMBTU	Million British Thermal Units
MTC	Metropolitan Transportation Commission
MTS	Metropolitan Transportation System
NAAQS	National Ambient Air Quality Standards
NO_x	Nitrogen oxides, or oxides of nitrogen
O_3	Ozone
PM_{10}	Particulate matter less than 10 microns
pphm	Parts per hundred million
ppm	Parts per million
PUC	Public Utilities Commission
ROG	Reactive organic gases (photochemically reactive organic compounds)
RIDES	RIDES for Bay Area Commuters
RTC	Regional Transit Connection
RTP	Regional Transportation Plan
RVP	Reid vapor pressure
SCAQMD	South Coast (Los Angeles area) Air Quality Management District
SCCTA	Santa Clara County Transportation Agency
SIP	State Implementation Plan
TCI	Transit Capital Improvement (Program)
TCM	Transportation control measure
TIP	Transportation Improvement Program
TMA	Transportation Management Association
TOS	Traffic Operations System
tpd	tons per day
UV	Ultraviolet
VMT	Vehicle miles traveled

INTRODUCTION

Pollutants in the air can cause health problems--especially for children, the elderly, and people with heart or lung problems. The harmful effects of air pollution have been recognized for many years, but scientific studies and legal procedures have been developed only in recent decades to define specific pollutants. Ozone, the principal component of smog, is one pollutant of concern.

Ozone is a strong oxidizing agent with a potential to damage living and inanimate things with which it comes in contact. When present in the lower atmosphere, even at low concentrations, ozone is harmful to human health and to property. Impaired respiratory function and cardiac stress are the most common health impacts of ozone pollution. Healthy adults may experience symptoms during periods of intense exercise. These are thought to be reversible acute effects, but there is some emerging evidence of chronic effects from long term exposure. Ozone also damages trees and other natural vegetation, reduces agricultural productivity and causes or accelerates deterioration of building materials, surface coatings, rubber, plastic products and textiles.

The State of California has set numerical standards to define unhealthful levels of air pollution. The relevant standard for this plan is ozone (O_3)* which should not exceed 0.09 parts per million over a one-hour average.

In most parts of the San Francisco Bay Area, air quality is good and is improving. Nevertheless, State standards are sometimes exceeded. In recent years, the ozone standard has been exceeded 15 to 25 times per year on hot summer days in the inland valleys of the Bay Area.

Because the region sometimes exceeds the State ozone standard, staff have prepared this *Bay Area '94 Clean Air Plan*. This Plan is the second in a series to be prepared at approximate three-year intervals, as required by State law. The '94 CAP covers the period from 1994 through 1997. Measures proposed for 1998 and beyond will be reconsidered in the comprehensive update expected in 1997.

The '94 CAP also reports the region's progress in meeting the State ozone and carbon monoxide standards since adoption of the '91 CAP, as required by State law. Because the State CO standard was attained, the '97 CAP, when developed, will report only on progress toward attainment of the State ozone standard.

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* Note that ozone near the ground is an air pollutant--an oxidizing agent harmful to people, animals, plants, and many materials. The same chemical compound in the stratosphere, about 10 miles above the Earth's surface, plays a beneficial role in protecting us from excessive ultraviolet radiation. Surface ozone and stratospheric ozone are independent phenomena, and the intent of this plan is to reduce *surface* ozone only.

The '91 CAP projected that by 1994, regional control measures aimed at curbing ozone would reduce reactive organic gases (ROG) by 19 tons per day and nitrogen oxides (NO_x) by 17 tons per day. Although less than previously expected, some progress has been made. Collectively, the '91 CAP's stationary source and transportation control measures (TCMs) that will be implemented through December 1994 are expected to result in an 11 tons per day reduction in ROG and a 3.4 tons per day reduction in NO_x. Total reductions from federal, State and regional programs since 1991 were 62 tons per day of ROG and 9 tons per day of NO_x.

Although there were no significant delays in District adoption of rules to reduce stationary source emissions, the compliance date for certain measures was extended from timeframes specified in the '91 CAP. For TCMs, the Employer-Based Trip Reduction Rule development process and shortfalls in transportation funding (from both State and federal sources) resulted in more modest implementation of TCMs than was expected in 1991. Prior commitments to major expansion projects, rehabilitation of existing facilities, and seismic safety needs stemming from the Loma Prieta and Northridge earthquakes, continued to consume limited transportation revenue.

Many agree that a new transportation revenue source is necessary in California. The federal theme of maintaining our highways and transit facilities, and making investments that increase the efficiency of existing facilities, if adhered to in a new State (or Bay Area) transportation revenue proposal, would likely increase the proportion of funding allotted to TCMs.

Although not projected in the '91 CAP, the Bay Area attained the State carbon monoxide standard in 1993. This is largely due to the dramatic effect of oxygenated fuels that were introduced in 1992.

Although the region's long term population growth rate is expected to be higher than was thought in 1991 (2.0 percent per year vs. a previous rate of 1.1 percent per year), and the number of miles driven by Bay Area residents is expected to increase faster than was thought in 1991 (1.2 percent per year vs. a previous rate of 0.8 percent per year), emissions of reactive organic gases, nitrogen oxides and carbon monoxide are all expected to be lower in the year 2000

New emissions factors applied to revised forecasts of population, employment, vehicle miles traveled (VMT) and industrial growth, yield estimated levels of emissions in the year 2000 that are lower than those outlined in the '91 CAP: 2 percent less for reactive organic gases and 11 percent less for nitrogen oxides. These lower levels of emissions will help us make additional progress toward attaining the State ozone standard--but not enough to reduce the stringency of the CAP

The '94 CAP proposes several new control measures, most notably in the mobile source area (see Table 4). These were developed in response to State law that requires implementation of "all feasible measures."

The CAP was prepared by the Bay Area Air Quality Management District, in cooperation with the Association of Bay Area Governments and the Metropolitan Transportation Commission.

It responds to requirements of the California Clean Air Act (CCAA) of 1988 and a related law, AB 3971 (Cortese, 1988). The CCAA set the overall air quality planning requirements Statewide. AB 3971 defined a process to be applied only in the Bay Area, whereby the transportation control measures required in the CCAA would be developed through a joint process between BAAQMD and MTC.

SOURCES OF AIR POLLUTION

There are literally millions of sources of air pollution in the Bay Area, ranging from industrial smoke stacks and motor vehicles to individual use of personal grooming products, household cleaners, and paints. The Earth, itself, and its plant and animal life are natural sources of air pollutants.

The source inventory summary in Table 1 and Figures 1 and 2 presents the District's best estimates of the total air pollutant emissions from human activities. In the Bay Area, human activity, or "anthropogenic" sources, are significantly greater than natural sources. The data presented in Table 1 are for 1987, the defined base year for State air quality planning, and for selected future years.

Table 1 shows inventory projections for the years 1994, 1997, and 2000. These projections are based on expected growth rates in population, employment, industrial/commercial activity, travel, and energy use, under environmental controls adopted as of March, 1994. They do not include the control measures proposed in the '94 CAP.

Some sources of air pollution are measured directly, but most are estimated based on source characteristics, throughput rates, partial sampling, and scientific or engineering calculations. Appendix H and the BAAQMD Inventory Methodology document, available from the District on request, provide more details on the inventory process and its results.

Motor vehicle emission calculations include consideration of the fleet mix (vehicle type, model year, and accumulated mileage), miles traveled, vehicle speeds, and vehicle emission factors, as developed from comprehensive ARB testing programs. The District also receives vehicle registration data from the Department of Motor Vehicles and vehicle emissions data from the Bureau of Automotive Repair. All of these variables change from year to year, and the projections are based upon expected changes.

TABLE 1

BAY AREA BASELINE* EMISSION INVENTORY PROJECTIONS: 1987 - 2000

Planning Inventory** (Tons/Day)

	Reactive Organic Gases [1]				Oxides of Nitrogen [2]				Carbon Monoxide [3]			
	1987	1994	1997	2000	1987	1994	1997	2000	1987	1994	1997	2000
Industrial/Commercial Processes/Facilities												
Petroleum Refining Facilities	20	17	15	16	11	12	12	12	1	1	1	1
Chemical Manufacturing Facilities	4	4	4	4	3	2	2	3	28	26	27	28
Other Industrial/Commercial Processes/Facilities	19	16	16	16	0	0	0	1	0	0	0	0
Petroleum Product/Solvent Evaporation												
Petroleum Refinery Evaporation	10	6	6	6	0	0	0	0	0	0	0	0
Fuels Distribution	23	23	23	24	0	0	0	0	0	0	0	0
Other Organic Compound Evaporation	129	114	104	103	0	0	0	0	0	0	0	0
Combustion - Stationary Sources												
Fuel Combustion	7	7	7	7	139	125	108	87	359	390	402	413
Burning of Waste Material	1	1	1	1	2	2	2	2	3	3	3	3
Banking (Current)	0	5	5	5	0	8	8	8	0	3	3	3
Sub Total (District Jurisdiction)	**212**	**192**	**182**	**181**	**154**	**150**	**134**	**113**	**390**	**423**	**435**	**448**
Combustion - Mobile Sources												
On-Road Motor Vehicles	359	217	162	138	290	208	178	169	3271	2062	1722	1399
Off-Highway Mobile Sources	62	68	66	65	162	171	180	186	386	449	470	473
Aircraft	18	19	20	20	15	17	17	18	51	57	60	62
Consumer Solvents and Other Sources	56	53	54	55	0	0	0	0	4	4	4	4
Grand Total	**706**	**548**	**483**	**459**	**621**	**545**	**510**	**486**	**4101**	**2994**	**2691**	**2387**

* Inventory and projections assume implementation of control measures adopted as of March 1, 1994.

** Anthropogenic or man-made emissions (does not include approximately 300 tpd of estimated ROG emissions from natural sources). Entries are rounded to nearest whole number, totals may not equal to sums of column entries.

1 Photochemically reactive organic gases, excludes methane and other non-reactives, for summer operating day.

2 Oxides of nitrogen (nitric oxide and/or nitrogen dioxide), NO_x as NO_2, for summer operating day.

3 Carbon monoxide emissions for winter operating day.

Figure 1
1994 Emissions: Ozone Precursors - Reactive Organic Gases
(548 tons/day)

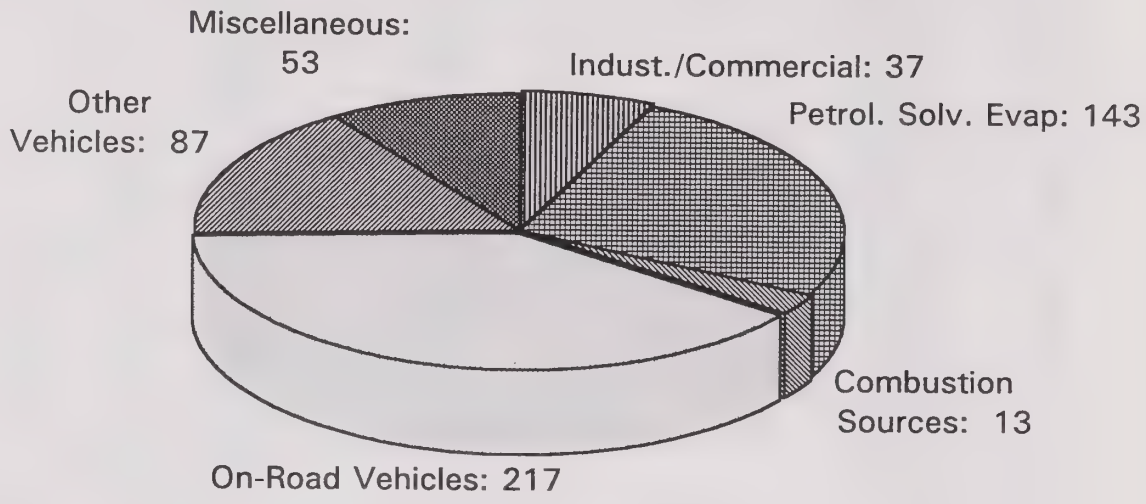
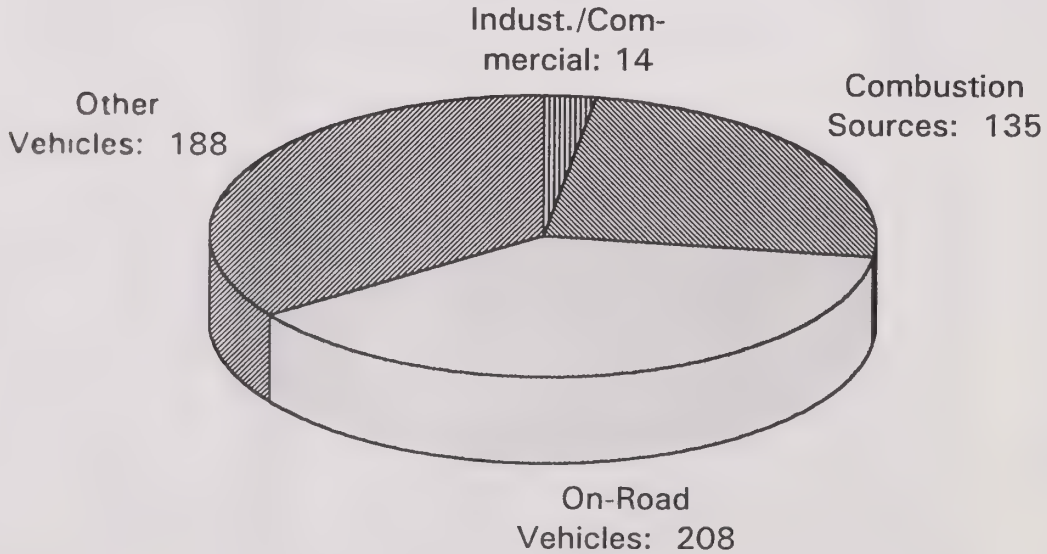


Figure 2
1994 Emissions: Ozone Precursors - Oxides of Nitrogen
(545 tons/day)



OZONE AND CARBON MONOXIDE TRENDS

The California Clean Air Act requires that each triennial plan revision include an assessment of changes in ambient concentrations of nonattainment pollutants. In the period since the passage of the California Clean Air Act, the Bay Area has continued to experience reductions in peak ozone and carbon monoxide levels.

Peak ozone concentrations have diminished 2.8% per year, on average, since 1986. This improvement is due to reductions in emissions of ozone precursors. The reductions are widespread, although some areas show greater improvements than others. The South Bay region appears to have shown the greatest improvement, while the eastern parts of the Bay Area have shown the least.

The Act also requires that population exposure to ozone be examined. Population exposure to ozone has been reduced by more than two thirds on average since 1986, a rate much larger than the rate of decrease in peak ozone concentrations. This is because most ozone exceedances in the Bay Area are only marginally above the ozone standard. A small reduction in peak ozone levels of, say, 10% can reduce the number of hours exceeding the ozone standard by 40% or 50%. In other words, a small reduction in peak ozone levels eliminates many hours with ozone concentrations at unhealthy levels above the standard. For additional information, see Appendix D, "Air Quality Improvement: 1991-1994."

Since 1987, carbon monoxide concentrations have also been reduced in the Bay Area. In 1992 and 1993, the District attained the State ambient standard for carbon monoxide and was redesignated to attainment status by ARB in November 1994. As shown in Table 1, CO emissions are projected to decline significantly through the year 2000. Therefore, we expect to maintain compliance with the State CO standard through the year 2000 and beyond.

LEGAL REQUIREMENTS

The California Clean Air Act of 1988, as amended, expanded the scope and accelerated the pace of air pollution control efforts in California. The basic intent of the Act is to establish a planning process that will result in attainment of the State's health-based ambient air quality standards at the earliest practicable date. If possible, District plans should achieve a reduction in districtwide emissions of 5% per year for ozone precursors (Sec. 40914). As an alternative strategy, the adoption of all feasible measures on an expeditious schedule is acceptable, even if a district is unable to achieve a 5% annual reduction (Sec. 40914 [b] [2]).

Because in 1992 the Bay Area's worst ozone readings approached 0.13 ppm, the region is subject to CCAA requirements for "serious" areas. (Sec. 40921.5[a][2]). These requirements, and the Bay Area's responses, include the following:

- Indirect source and area source control programs. *TCM 15 - Local Clean Air Plans, Policies and Programs addresses the Indirect Source requirement. Control of area source emissions is addressed through existing BAAQMD regulations, various proposed control measures in Table 4, and TCM 16 - Intermittent Control Measure / Public Education.*
- Emissions tracking systems. *The BAAQMD tracks emissions through its emissions inventory system, and receives annual emissions statements from permitted point sources.*
- A regional public education program. *BAAQMD's "Spare the Air" public education program is aimed at curbing emissions from motor vehicles and other ROG-emitting sources on forecasted State ozone exceedance days (summer), and "Don't Light Tonight" is aimed at reducing woodburning during the winter. Other ongoing activities include a Speaker's Bureau, Smoking Vehicle Program and grassroots resource teams in each of the Bay Area counties.*
- Best available retrofit control technology (BARCT) on existing stationary sources. *BARCT is applied through BAAQMD regulations on permitted point sources totaling 84 percent of the 1987 ROG inventory and 80 percent of the 1987 NO_x inventory. BAAQMD coverage, therefore, achieves and exceeds the State requirement of 75 percent.*
- Transportation controls to achieve a 1.4 average vehicle ridership during weekday commute hours by 1999 and no net increase in motor vehicle emissions after 1997 (Sec. 40919 [d]). *The 1994 Regional Transportation Plan projects average vehicle ridership to approximate 1.4 in 1999. The Bay Area emission inventory (see Table 1) projects declining motor vehicle emissions through 2000.*

- A permitting program designed to achieve no net increase in emissions from permitted sources with a potential to emit greater than 15 tons per year of a nonattainment contaminant, also a requirement for the use of BACT on new and modified sources with a potential to emit greater than 10 pounds per day. ***BAAQMD Regulation 2, Rule 2 meets the requirements.***
- Measures to achieve a significant number of low-emission vehicles in motor vehicle fleets. *Proposed mobile source control measure M4 - Low Emission Vehicle Fleet Operations, addresses control of motor vehicle fleet emissions.*
- An assessment of cost-effectiveness of proposed control measures (Sec. 40922). *See "Cost Effectiveness Estimates" section of this document.*
- Transport mitigation requirements (Sec. 39610 [b]). *The specific State transport mitigation requirements for the Bay Area are addressed through achievement of the BARCT requirement and the no net increase permit system as listed above.*[1]

Continuing legal requirements include:

- An annual regulatory schedule (Sec. 40923). ***BAAQMD produces a regulatory schedule each January, as required. That schedule is periodically updated.***
- An annual progress report on control measure implementation and, every third year, an assessment of the overall effectiveness of the program (Sec. 40924). ***BAAQMD prepared annual progress reports in December 1992 and December 1993.*** *This Plan includes the required assessment of Plan effectiveness, commonly referred to as the "Triennial Progress Report." The Triennial Progress Report is comprised of the following sections of this document:*

  * *Ozone and Carbon Monoxide Trends, including Appendix D;*
  * *Adopted Control Measures and Programs; and*
  * *Meeting CCAA Performance Standards, including Appendix B.*

- A review and update of the Plan every three years to correct for deficiencies and to incorporate new data, with submission of a comprehensive update in 1997 (Sec. 40925). *This Plan incorporates new data and necessary changes to the '91 CAP. The BAAQMD will prepare a comprehensive update of the CAP in 1997.*

[1] All State, federal and regional programs to reduce Bay Area emissions will tend to reduce transport.

ADOPTED CONTROL MEASURES AND PROGRAMS

This section summarizes control measures and programs from the 1991 CAP that were adopted or had commitments made to implementation from 1991-1994. Table 2 summarizes stationary, intermittent and non-TCM mobile source control measures that were adopted, and provides an estimate of the range of emission reductions expected from these measures. Table 3 illustrates '91 CAP TCMs that were implemented by 1994[2].

Several 1991 CAP control measures have not been adopted and are proposed for deletion from the 1994 CAP, generally for cost effectiveness or technological feasibility reasons. These are:

Control Measure		Reason for Deletion
A10(a)	ROG limits for solvent/surface coatings	No further emission reduction achievable
A11(b)	Transfer efficiency standards for adhesives	Not technologically feasible
A11(c)	Adhesives cleanup operations	Will be implemented through A18
A13(b&d)	Graphic arts printing: automatic press blankets and enclosed doctor blades	Not cost effective
D9	Residential wood combustion	District will propose regulation in 1995 as a PM_{10} control strategy. Was included in '91 CAP for CO control; District met State CO standard in '93.
G2 (a2)	Mandatory postponement of industrial activities on forecasted ozone excess days	Voluntary program [G2(a1)] is ongoing. District is not considering mandatory program at this time, since small additional benefits from a mandatory program would be costly and difficult to enforce.

[2] Although no TCMs are proposed for deletion from the 1994 CAP, certain TCM numbers shown in the '91 CAP have changed. The TCM numbers shown are based on the new TCM numbers in this plan. A separate table illustrates the relationship between the '91 CAP TCMs and the '94 CAP TCMs. The table is available from the District, upon request.

TABLE 2

ADOPTED STATIONARY AND MOBILE SOURCE CONTROL MEASURES: 1991-1994

CONTROL MEASURES	EMISSION REDUCTION AFTER IMPLEMENTATION		BAAQMD REGULATION
	ROG	*NO_x*	
A. SURFACE COATING AND SOLVENT USE			
A3 IMPROVED AEROSPACE COATINGS RULE (a) Set transfer efficiency standards	0.02-0.03		8-29
A4 IMPROVED WOOD FURNITURE AND CABINET COATINGS RULE (a) Establish ROG limits for coatings (b) Eliminate small user exemption	5.8-6.5		8-32
A5 IMPROVED SURFACE COATING OF MISCELLANEOUS METAL PARTS AND PRODUCTS RULE (a) Set transfer efficiency standards	0.06-0.13		8-19
A6 IMPROVED SURFACE COATING OF PLASTIC PARTS AND PRODUCTS RULE (a) Set transfer efficiency standards	negligible		8-31
A10 IMPROVED GENERAL SOLVENT AND SURFACE COATING RULE (b) Modify mass emission limits	unknown		8-4
A11 FURTHER CONTROL OF EMISSIONS FROM ADHESIVES USE (a) Establish ROG limits for adhesives	13		8-51
A12 ELIMINATION OF COATINGS RULES / ALTERNATIVE EMISSION CONTROL PLANS (a) Eliminate or modify AECP provisions in Reg. 8 Rules	Unknown		8-12, 8-13, 8-14, 8-19, 8-23, 8-29, 8-30, 8-31, 8-32 & 8-38
A13 IMPROVED GRAPHIC ARTS PRINTING OPERATIONS RULE (a) Lower ROG limits for fountain solutions (c) Lower ROG limits for inks	1.3		8-20
A14 IMPROVED COATINGS AND INK MANUFACTURING RULE (b) Eliminate the small manufacturer exemption (c) Require reduced emissions from vat cleaning	0.3-0.5		8-35
B. FUELS/ORGANIC LIQUIDS STORAGE AND DISTRIBUTION			
B2 IMPROVED STORAGE OF ORGANIC LIQUIDS RULE (c) Require better tank seals/more frequent inspections (g) Require emissions to be controlled during tank cleaning	2-3		8-5
B3 IMPROVED ORGANIC CHEMICAL TERMINALS & BULK PLANTS RULE (a) Reduce emission standard for non-gasoline bulk terminals and plants	0.01		8-6

TABLE 2 (Cont'd)

ADOPTED STATIONARY AND MOBILE SOURCE CONTROL MEASURES: 1991 - 1994

CONTROL MEASURES	EMISSION REDUCTION AFTER IMPLEMENTATION		BAAQMD REGULATION
	ROG	*NO_x*	
C. REFINERY AND CHEMICAL PLANT PROCESSES			
C2 IMPROVED PUMP AND COMPRESSOR SEALS AT REFINERIES AND CHEMICAL PLANTS RULE (a) Require leakless seals (b) Adopt a more stringent leak definition	6.5		8-18
C3 IMPROVED VALVES AND FLANGES AT REFINERIES AND CHEMICAL PLANTS RULE (a) Require leakless valves (b) Improve inspection and maintenance requirements (c) Adopt a more stringent leak definition	included in C2 above		8-22 & 8-25
C6 FURTHER CONTROL OF EMISSIONS FROM WASTEWATER TREATMENT AT REFINERIES (c) Require controls for hydrocarbon-pond desludging	unknown		8-8
D. COMBUSTION OF FUELS			
D1 CONTROL OF EMISSIONS FROM NON-UTILITY RECIPROCATING ENGINES (a) Adopt NOx controls similar to existing SCAQMD Rule 1110.2		8.3	9-8
D2 CONTROL OF EMISSIONS FROM STATIONARY GAS TURBINES (a) Adopt NOx controls similar to existing SCAQMD Rule 1134		7	9-9
D3 CONTROL OF EMISSIONS FROM ELECTRIC POWER GENERATING BOILERS (a) Adopt NOx controls based on add-on flue gas controls		10-25	9-11
D4 CONTROL OF EMISSIONS FROM BOILERS, STEAM GENERATORS, AND PROCESS HEATERS (a) Adopt NOx controls similar to existing SCAQMD Rule 1146 (1) Large units (100 MMBTU/hr. or larger) (2) Smaller units (less than 100 MMBTU/hr.)		21	9-10 & 9-7
D5 CONTROL OF EMISSIONS FROM CEMENT PLANT KILNS (a) Adopt NOx controls similar to existing SCAQMD Rule 1112		0	Source-specific SIP submittal
D6 CONTROL OF EMISSIONS FROM GLASS MANUFACTURING PLANT MELTING FURNACES (a) Adopt NOx controls similar to existing SCAQMD Rule 1117		1.2	9-12
D7 CONTROL OF EMISSIONS FROM RESIDENTIAL WATER HEATING (a) Adopt NOx standards for new residential and commercial water heaters		3.3	9-6

TABLE 2 (Cont'd)

ADOPTED STATIONARY AND MOBILE SOURCE CONTROL MEASURES: 1991 - 1994

CONTROL MEASURES	EMISSION REDUCTION AFTER IMPLEMENTATION		BAAQMD REGULATION
	ROG	*NO_x*	
F. OTHER STATIONARY SOURCE CONTROL MEASURES			
F1 IMPROVED NEW SOURCE REVIEW RULE	unknown	unknown	2-2
F4 ENHANCED ENFORCEMENT OF EXISTING DISTRICT REGULATIONS (a) Implement a program to increase compliance with District regulations	unknown		Various Regulation 8 rules monitoring requirements
G. INTERMITTENT CONTROL MEASURES			
G1 CITIZEN POSTPONEMENT OF DISCRETIONARY ACTIVITIES (a) Encourage postponement of certain activities during forecast ozone excess days	unknown	unknown	Program initiated in 1991
G2 INDUSTRIAL POSTPONEMENT OF ACTIVITIES DURING FORECAST OZONE EXCESS DAYS (a) Implement a program directed at postponement of certain industrial activities during forecast ozone excess days (1) Voluntary	unknown	unknown	Program initiated in 1992
H. BAAQMD PROGRAMS AFFECTING MOTOR VEHICLES			
H1 SMOKING VEHICLE PROGRAM (a) Implement a citizen complaint program for smoking vehicles	0.08	0.18	Program initiated in 1992
M. MOBILE SOURCE CONTROL MEASURES			
M1 MOBILE SOURCE EMISSION REDUCTION CREDIT PROGRAM (a) Vehicle buy-back program	Unknown	Unknown	Manual of Procedures Chapter VIII
TOTAL EMISSIONS REDUCED	**29 - 31**	**51 - 66**	

TABLE 3

IMPLEMENTED TRANSPORTATION CONTROL MEASURES: 1991 - 1994

CONTROL MEASURES	PERCENT EMISSION REDUCTION		
	ROG	NOx	CO
TCMs 1 & 2: Employer Assistance / Employer Based Trip Reduction (EBTR) Model Trip Reduction Ordinance Prepared EBTR Rule Adopted Trip Reduction Projects Funded by Transportation Fund for Clean Air	.08	.07	.06
TCM 3: Improve Areawide Transit Service Post Earthquake BART Service Continued, which Includes Faster Running Speeds and Earlier Start Times CalTrain Service Increased from 54 to 60 Trains per Day Service Extended to Gilroy Transit Projects Funded by Transportation Fund for Clean Air	.26	.26	.21
TCM 5: Improve Access to Rail and Ferries Federal Funds Awarded to Certain Projects by MTC Projects Funded by Transportation Fund for Clean Air	.07	.09	unknown
TCM 6: Improve Intercity Rail Service 3 Round Trips per Day between Roseville and San Jose Provided	.05	.05	.04
TCM 7: Improve Ferry Service Post Earthquake (Alameda/Oakland to San Francisco) Ferry Service Continued Ferry Service Provided Between Bay Harbor Isle (near Alameda) and San Francisco	.03	.02	.02
TCM 8: Construct Carpool / Express Bus Lanes on Freeways Approximately 60 High Occupancy Vehicle (HOV) Lane Miles Opened (for a total of 140 Lane Miles)	.03	.03	.03
TCM 9: Improve Bicycle Access and Facilities Bicycle Advisory Committees Established in all nine Bay Area counties Federal and State Funds Awarded to Bicycle Projects by MTC and Caltrans Bicycle Projects Funded by Transportation Fund for Clean Air	.01	< .01	unknown
TCM 10: Youth Transportation Projects Funded by Transportation Fund for Clean Air	.01	< .01	unknown

TABLE 3 (Cont'd)

IMPLEMENTED TRANSPORTATION CONTROL MEASURES: 1991 - 1994

CONTROL MEASURES	PERCENT EMISSION REDUCTION		
	ROG	NOx	CO
TCM 11: Install Freeway Traffic Operations System (TOS) Freeway Service Patrols Now Operate on 165 miles of Bay Area Freeways	.12	.06	.12
TCM 12: Improve Arterial Traffic Management Federal Funds Awarded to Traffic Signalization Projects by MTC Traffic Signalization Projects Funded by Transportation Fund for Clean Air	.07	.04	.07
TCM 13: Transit Use Incentives 22 Additional Companies Participate in Regional Transit Connection Cumulative Sales to Date for the Commuter Check Program are $2 Million Transit Incentive Projects Funded by Transportation Fund for Clean Air	.04	.05	.02
TCM 15: Local Clean Air Plans, Policies & Programs As of December 1991, 31 Jurisdictions had Prepared and Adopted Local Air Quality Plans or Air Quality Elements of their General Plans. Since then, other jurisdictions are working on plans or updates of already adopted plans. MTC Awards Higher Scores to Projects that Support High Density Development in their Scoring of Projects Submitted for Federal Transportation Funds. MTC Analyzed Transit-Oriented Development to inform Development of the *1994 Regional Transportation Plan.* Transit-Oriented Development has occurred at the Pleasant Hill and El Cerrito del Norte BART Stations.	unknown	unknown	unknown
TCM 16: Intermittent Control Measure / Public Education BAAQMD developed the *Spare the Air* and *Don't Light Tonight* Programs, which are operational.	unknown	unknown	unknown
TCM 17: Conduct Demonstration Projects Two telecommuting centers were opened using State and Federal funds. Centers are now closed. Projects Funded by Transportation Fund for Clean Air. Caltrans and MTC were awarded the nation's only Congestion Pricing Demonstration Project on the Oakland-San Francisco Bay Bridge, for which planning studies are underway.	.01	.01	unknown

TABLE 3 (Cont'd)

IMPLEMENTED TRANSPORTATION CONTROL MEASURES 1991 - 1994

CONTROL MEASURES	PERCENT EMISSION REDUCTION		
	ROG	NOx	CO
TCM 18: Implement Revenue Measures State Gas Tax Increased 9 cents per gallon (to 18 cents) Federal Gas Tax Increased 5 cents per gallon* (to 18.6 cents) Motor Vehicle Registration Fees Increased $4.00 per Year (more in some counties) Golden Gate Bridge Toll Increased by $2.00 to $3.00*	.79	.79	.77
TCM 19: Implement Market-Based Pricing Measures State legislation was enacted requiring employers of 50 or more who lease parking to offer a cash subsidy to employees	unknown	unknown	unknown
CM M4: Low Emission Vehicle Fleet Operations Clean Fuel Projects Funded by Transportation Fund for Clean Air	.02	.02	unknown
TOTAL PERCENT REDUCTION	**1.6%**	**1.5%**	**1.3%**
1994 INVENTORY (tons per day)	**217**	**208**	**2062**
TOTAL DAILY TONS REDUCED	**3.5**	**3.1**	**26.8**

* Not included in the '91 CAP TCMs. Emissions reduction associated with these measures has been included in the estimate of percent emissions reduction shown in this table.

STRATEGY

The overall goal of this planning process is to reduce the health impacts of ozone in ambient air. The District's goal to reduce by 1994 per capita exposure by 50% to pollutant levels which exceed the State standard has been met. It appears likely that the goal of reducing by 1997 exposure by 75% will be met. (For more detail, see Appendix D - Air Quality Improvement: 1991-1994).

The strategy for this air quality plan is to implement all feasible measures on an expeditious schedule in order to reduce pollutant emissions as quickly as possible.

Areas that cannot achieve the 5% per year pollutant reduction target specified in the California Clean Air Act can comply with an alternative requirement of the Act, Section 40914 (b) (2), which requires that a plan include every feasible measure and an expeditious adoption schedule.

Neither "feasible" nor "expeditious" is defined in the Act . For the '94 CAP, the District will maintain the definitions set forth in the '91 CAP:

> Feasible measures are those measures which are 1) reasonable and necessary for the San Francisco Bay Area, 2) capable of being implemented in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors, and 3) approved or approvable by the California Air Resources Board, based upon State law and ARB policies.
>
> An expeditious adoption schedule is the adoption of eight Plan measures per year.

The definition of feasible was derived from common usage meanings, the definition used in a related area of State law, and Air Resources Board guidance (see Appendix A for details). The BAAQMD may also periodically review control measures adopted and implemented by other California air districts, in order to identify additional measures that may be applicable in the Bay Area.

The strategy also includes the related objectives below:

- Implementation of a no net increase permit system for new and modified stationary sources with a potential to emit greater than 15 tons per year of an ozone precursor
- Adoption of rules requiring best available retrofit control technology on permitted sources representing 75% of the 1987 ozone precursor inventory

These actions were taken to satisfy ARB regulations for mitigation of air pollutant transport to other districts.

Finally, the strategy includes adoption of transportation control measures in order to achieve by 1999 an average of approximately 1.4 persons per passenger vehicle during commute hours.

Given a strategy to implement all feasible measures on an expeditious adoption schedule, the treatment of contingency measures must be considered. Section 40915 of the Act requires that contingency measures be adopted if ARB finds that a district fails to achieve or maintain adequate progress toward its reduction goals.

In the past, some districts have maintained a separate list of contingency measures to be adopted if one or more of the core measures in their plans did not produce the expected results. These contingency measures were usually more costly or more difficult to implement, and therefore had not been included in the core measure list at the time of plan adoption. In the current planning process, it does not make sense to identify contingency measures that are not deemed feasible at the time of plan adoption but that might later be inserted into the regulation adoption sequence in preference to other scheduled feasible measures. Therefore, the contingency procedure for the Bay Area '94 CAP is the following:

1. The BAAQMD and cooperating agencies will strive to adopt and implement measures on the schedules set forth in this Plan and subsequent annual regulatory schedules.

2. When a Plan measure cannot be adopted or implemented, the District will accelerate, to the extent possible, the rule adoption and implementation process for the subsequent rule(s).

3. In the annual progress reports required under Section 40924, the BAAQMD will report on the rule adoption process, including any delays or failures, and describe efforts to accelerate development and adoption of subsequent feasible measures.

4. If additional measures not currently in this Plan are identified as feasible, would achieve significant emission reductions, and would be more cost-effective than some measures already in the Plan, the BAAQMD will incorporate those measures into the annual regulatory schedules with a priority commensurate with their superiority to the other Plan measures awaiting adoption.

PROPOSED CONTROL MEASURES AND PROGRAMS

This section summarizes the new control measures and programs in the '94 CAP and the expected activities for the subsequent triennial update in 1997. The regulatory schedule for the '94 CAP is provided in Table 9, and detailed descriptions of the measures are provided in Appendices F and G.

Stationary and Mobile Source Control Measures

A comprehensive list of potential stationary and mobile source controls was compiled from suggestions by BAAQMD employees and others and from the literature and proposals of other jurisdictions. Where information was available, these potential control measures were screened for total emission reduction potential, rate of reduction, cost-effectiveness, public acceptability, and enforceability. The measures listed in Tables 4 and 5 constitute all feasible measures for the Bay Area. Several new stationary and mobile source control measures have been added to the '94 CAP--these are illustrated by shading text in Table 4.

Existing BAAQMD regulations, plus the new stationary source proposals in the CAP, cover all the applicable measures on ARB's "List of Feasible Measures for Stationary Sources" (March 1991). A few measures on the ARB list are not included because no corresponding sources (such as kelp-processing) exist in the Bay Area.

Table 4 lists the stationary and mobile source control measures to be developed and proposed for adoption. Included in the table are:

- Brief descriptions of proposed measures
- Estimated cost-effectiveness
- Estimated potential emission reductions
- Projected implementation dates
- Ratings of technical feasibility, public acceptability, and enforceability
- Proposed adoption dates

The BAAQMD will be the responsible implementing agency for all of the stationary source control measures, except A17 (Control of Emissions from Household Solvent Disposal) and B4 (Further Reductions from Gasoline Delivery Vehicles). A17 would be implemented by cities and counties. B4 is under the jurisdiction of the ARB.

Collectively, the proposed stationary and mobile source control measures are expected to reduce reactive organic gases by 5.8 tons per day in 1997 and 36 tons per day when all measures are fully implemented. They are expected to reduce NO_x emissions by 1.4 tons per day in 1997 and 4 tons per day when fully implemented. More detailed information on the measures is available in Appendix G (Volume III of the CAP).

Table 4

1994 CLEAN AIR PLAN STATIONARY AND MOBILE SOURCE CONTROL MEASURES

CM#	TITLE OF CONTROL MEASURE	Cost Effectiveness $/ton reduced	Total ROG ER Potential tons/day	Rate of Reduction imp. date	Technology. Feasibility A thru D	Public Acceptance A thru D	Enforce. A thru D	Proposed Adoption
A.	**SURFACE COATING AND SOLVENT USE**							
A1	IMPROVED ARCHITECTURAL AND INDUSTRIAL MAINTENANCE COATINGS RULE							
	(a) Lower ROG limits for some specialty coatings	$2000	1.54 - 2.24	2000+	D	B	B	2000+
	(b) Eliminate small container exemption	$2000		9/98	D	B	B	1997
A3	IMPROVED AEROSPACE COATINGS RULE							
	(b) Lower ROG limits for some specialty coatings	$2000	.29 .41	1/98	D	A	B	1997
A5	IMPROVED SURFACE COATING OF MISC. METAL PARTS AND PRODUCTS RULE							
	(b) Lower ROG limits for some specialty coatings	$2000	.24 - .48	1/98	D	A	B	1997
A6	IMPROVED SURFACE COATING OF PLASTIC PARTS AND PRODUCTS RULE							
	(b) Lower ROG limits for some coatings	$2000	.32 - .43	1/98	D	A	B	1997
A7	IMPROVED CAN AND COIL COATING RULE							
	(a) Lower ROG limits for some coatings	$2000	.38 - .76	1/98	D	A	B	1997
A8	IMPROVED MAGNET WIRE COATING OPERATIONS RULE							
	(a) Modify or eliminate exemptions	$2000	.12 - .14	1/98	C	A	B	1997
A9	IMPROVED AUTOMOBILE ASSEMBLY COATING OPERATIONS RULE							
	(a) Require add-on controls on some coating operations	$19000	.74 - 1.1	2000+	B	A	A	2000+
	(b) Lower ROG limits for some coatings	$2000		2000+	D	A	B	2000+
A14	IMPROVED COATINGS AND INK MANUFACTURING RULE							
	(a) Abate emissions from large mixing operations	$6000	.50 - .67	2000+	B	A	C	98 - 2000
A15	IMPROVED RESIN MANUFACTURING RULE							
	(a) Abate pellet extrusion and final product packaging	unknown	unknown	2000+	B	A	A	2000+
A16	IMPROVED SEMICONDUCTOR MANUFACTURING OPERATIONS RULE							
	(a) Abate emissions from positive photoresist operations	$4000 (a-b)	.07 - .08	2000+	A	A	A	98 - 2000
	(b) Abate emissions from solvent cleaning performed with coating-type applicators			2000+	A	A	A	98 - 2000
A17	CONTROL OF EMISSIONS FROM HOUSEHOLD SOLVENT DISPOSAL							
	(a) Encourage cities and counties to implement programs for proper disposal of ROG-containing household wastes	unknown	.22	2000+	B	B	D	98 - 2000

Table 4 (Con't)

1994 CLEAN AIR PLAN STATIONARY AND MOBILE SOURCE CONTROL MEASURES

CM#	TITLE OF CONTROL MEASURE	Cost Effectiveness $/ton reduced	Total ROG ER Potential tons/day	Rate of Reduction imp. date	Technology. Feasibility A thru D	Public Acceptance A thru D	Enforce. A thru D	Proposed Adoption
A18	SUBSTITUTE SOLVENTS USED FOR SURFACE PREPARATION/ CLEANUP OF COATINGS							
	(a) Set ROG/volatility limits for surface preparation solvents	$1100 (a-b)	7.6 - 11.4	1/96	B	A	C	1995
	(b) Set ROG/volatility limits for cleanup solvents			7/97	C	A	C	1995
A19	ULTRA-LOW ROG COATINGS							
	(a) Set ROG limits for coatings based on Vernonia oil substitution and/or UV curable	unknown	20.2 - 21.3	2000+	D	B	A	2000+
A20	CONTROL OF EMISSIONS FROM POLYSTYRENE MANUFACTURING	$2000	.04	7/97	A	A	A	1995
B.	**FUELS/ORGANIC LIQUIDS STORAGE AND DISTRIBUTION**							
B1	CONTROL OF EMISSIONS FROM RAILCAR LOADING							
	(a) Require vapor recovery systems on railcar loading of organic liquids	$4,000	unknown	7/95	B	A	C	1995
B2	IMPROVED STORAGE OF ORGANIC LIQUIDS RULE							
	(a) Adopt more stringent standards for cone roof tanks	$2000 (a-f)	1.0 - 1.3	7/97	B	A	A	1996
	(b) Lower or replace small tank exemption with a throughput exemption			7/97	B	A	A	1996
	(e) Require vapor recovery for certain tanks			7/97	B	A	A	1996
	(f) Require compliance-based floating roof tank vapor recovery retrofit			1/98	B	A	A	1996
B4	FURTHER EMISSION REDUCTIONS FROM GASOLINE DELIVERY VEHICLES							
	(a) Increase stringency of gasoline cargo tank vapor recovery requirements	savings	.05 - .07	1/97	A	A	B	1997
B5	LIMITATIONS ON MARINE VESSEL TANK PURGING							
	(a) Require control of ballasting and housekeeping emissions	$4200	1.3 - 1.4	1/96	B	A	C	1995
B6	CONTROL OF EMISSIONS FROM CLEANING-UP ORGANIC LIQUIDS							
	(a) Require control of emissions from cleaning storage tanks, vessels, and ROG spills	$42000	unknown	2000+	A	A	C	98 - 2000
B7	CONTROL OF EMISSIONS FROM PROPANE HANDLING							
	(a) Require propane tanks to be filled by pumping	unknown	unknown	2000+	D	C	A	2000+
	(b) Ban uncontrolled venting during servicing	unknown		2000+	D	C	D	2000+
B8	IMPROVED GASOLINE DISPENSING FACILITY RULE	$1000	1.0	7/97	A	A	B	1996
C.	**REFINERY AND CHEMICAL PLANT PROCESSES**							
C1	IMPROVED PRESSURE RELIEF VALVES AT REFINERIES AND CHEMICAL PLANTS RULE							
	(a) Require venting to abatement devices and/or rupture disks with tell-tale indicators	$10000	.36 - .48	1/96	A	A	B	1995

Table 4 (Con't)

1994 CLEAN AIR PLAN STATIONARY AND MOBILE SOURCE CONTROL MEASURES

CM#	TITLE OF CONTROL MEASURE	Cost Effectiveness $/ton reduced	Total ROG ER Potential tons/day	Rate of Reduction imp. date	Technology. Feasibility A thru D	Public Acceptance A thru D	Enforce. A thru D	Proposed Adoption
C4	IMPROVED PROCESS VESSEL DEPRESSURIZATION RULE							
	(a) Improve depressurization standards	$1000	.03 - .07	2000+	C	A	B	98 - 2000
	(b) Set blowdown sizing requirements	unknown		2000+	C	A	A	98 - 2000
C5	IMPROVED WASTEWATER (OIL-WATER) SEPARATORS RULE							
	(a) Remove small wastewater separator exemption	$1000	2.4 - 2.5	2000+	B	A	A	98 - 2000
	(b) Require large units to be vented to abatement devices	$3000		2000+	B	A	A	1995
C6	FURTHER CONTROL OF EMISSIONS FROM WASTEWATER TREATMENT AT REFINERIES							
	(a) Require treatment systems to be enclosed and abated or control wastewater stream	$10000 (a-b)	1.7 - 1.8	2000+	A	A	A	98 - 2000
	(b) Require covers for holding tanks and wastewater processing equipment			2000+	A	A	A	1995
C7	CONTROL OF EMISSIONS FROM PETROLEUM REFINERY FLARES							
	(a) Increase the capacity of blowdown recovery	unknown	.19-.22(R)	2000+	B	A	A	98 - 2000
	(b) Improve flare design and operating parameters	unknown	.07-.09(NOx)	2000+	C	A	A	98 - 2000
C8	DRAINING OF LIQUID PRODUCTS/SUMPS AND PITS	$8500	1.0	7/96	A	A	A	1995
D.	**COMBUSTION OF FUELS**							
D5	CONTROL OF EMISSIONS FROM CEMENT PLANT KILNS							
	(b) Adopt NOx controls requiring flue-gas treatment	$2000	2.7 - 3.3 (NOx)	2000+	D	B	B	2000+
E.	**OTHER INDUSTRIAL/COMMERCIAL PROCESSES**							
E1	CONTROL OF EMISSIONS FROM RUBBER PRODUCTS MANUFACTURING							
	(a) Require abatement of ROG emissions from rubber product manufacturing operations	$6000	unknown	2000+	C	A	B	98 - 2000
E3	CONTROL OF EMISSIONS FROM COMMERCIAL CHARBROILING							
	(a) Set ROG emission limits for commercial charbroilers	$25000	1.4	2000+	B	B	A	2000+
F.	**OTHER STATIONARY SOURCE CONTROL MEASURES**							
F3	PROMOTION OF ENERGY EFFICIENCY							
	(a) Establish a goal of increasing energy efficiency	unknown	unknown	1/97	A	A	D	1996

Table 4 (Con't)

1994 CLEAN AIR PLAN STATIONARY AND MOBILE SOURCE CONTROL MEASURES

CM#	TITLE OF CONTROL MEASURE	Cost Effectiveness $/ton reduced	Total ROG ER Potential tons/day	Rate of Reduction imp. date	Technology. Feasibility A thru D	Public Acceptance A thru D	Enforce. A thru D	Proposed Adoption
M.	MOBILE SOURCE CONTROL MEASURES							
M1	MOBILE SOURCE EMISSION REDUCTION CREDIT PROGRAMS							
	(b) Remote sensing of gross emitters	unknown	unknown	7/97	A	A	A	1996
	(c) Clean fuel fleet vehicles	unknown	unknown	7/97	A	A	A	1996
	(d) Bus/heavy duty truck retrofit	unknown	unknown	7/98	A	A	A	1997
M2	AIRPORT GROUND SUPPORT EQUIPMENT	unknown	.42 (R) 1.06 (NOx)	7/97	A	A	B	1996
M3	GROUND POWER SYSTEMS AT AIRPORT TERMINALS	unknown	.03 (R) .25 (NOx)	7/97	A	A	A	1996
M4	LOW EMISSION VEHICLE FLEET OPERATIONS		.37 (R)					
	(a) Enforcement of Vehicle Code requirements	unknown	.13 (NOx)	7/97	A	A	C	1996
M5	PUBLICLY FUNDED VEHICLE BUY-BACK AND REPAIR PROGRAM	$7000 $22000(NOx)	.13 (R) .04 (NOx)	7/96	A	A	B	1995

NOTES

Cost-Effectiveness is the estimated **average** value for all sources affected by the control measure.

Total Emission Reduction (ER) Potential is the summer day emission reductions (of ROG, unless otherwise specified) projected for the entire control measure (i.e. all control options) for the year 1997, assuming the measure is fully implemented in the absence of other competing control measures not currently adopted. In many cases, ranges of emission reductions are provided to address the uncertainty that exists in the estimates.

Rate of Reduction is the estimated date that the control measure will be fully implemented. An implementation date of "2000+" means the control measure is not anticipated to be implemented until after the year 2000. It should be noted that as control measures go through the rulemaking process, more detailed information will be developed regarding feasible implementation dates.

Technological Feasibility, Public Acceptability, and Enforceability were graded on a scale of A through D, with an A being the highest rating and a D being the lowest.

Proposed Adoption indicates the date in which the control measure is expected to be adopted. For near-term control measures, a specific year is listed; for longer-term measures, for which specific adoption dates are more uncertain, the anticipated planning period in which adoption is expected is specified.

Proposed New Control Measure (not part of '91 CAP)

Transportation Control Measures

On-road motor vehicles are the major source of air pollution in the Bay Area (see Table 1). They currently produce about 40% of the ozone precursors in the region. This section addresses measures to reduce emissions from motor vehicles by reducing vehicle use.

CCAA Transportation Requirements

The California Clean Air Act (CCAA) states that, in developing attainment plans, air districts shall "focus particular attention on reducing the emissions from transportation and areawide emission sources" (Sec. 40910). The Act specifically requires air districts to adopt, implement, and enforce transportation control measures (TCMs). TCMs are defined as "any strategy to reduce vehicle trips, vehicle use, vehicle miles traveled, vehicle idling, or traffic congestion for the purpose of reducing motor vehicle emissions" (Sec. 40717 [g]).

ARB released a list of "reasonably available" TCMs in CCAA Guidance #2 (February 1990). The measures include employer-based trip reduction rules, trip reduction rules for other sources that attract vehicle trips, management of parking supply and pricing, regional high occupancy vehicle (HOV) system plans, comprehensive transit improvement for bus and rail, land development policies that support reductions in vehicle trips, and development policies to strengthen on-site transit access for new and existing development.

Because the Bay Area is classified as "serious", the CCAA also requires that TCMs be sufficient to meet three specific transportation performance standards:

1) Substantially reduce the rate of increase in vehicle trips and vehicle miles traveled (VMT).

2) Achieve an average vehicle ridership (AVR) of at least 1.4 persons per passenger vehicle (including public transit) during weekday commute hours by 1999.

3) Achieve no net increase in vehicle emissions after 1997.

In addition to developing "reasonably available" transportation control measures, air districts are also required to develop an indirect source control program to reduce emissions from sources that generate or attract motor vehicle trips.

Rationale for TCMs

The average light duty motor vehicle has become much cleaner over the past 25 years, due to stronger tailpipe controls, cleaner fuels, and the Inspection and Maintenance (I&M) program. With these controls, today's cars are about 90% cleaner than their counterparts of twenty-five years ago. Despite these measures, the rapid increase in motor vehicle use has attenuated progress toward attainment of State clean air standards. Over the past twenty years, vehicle miles traveled (VMT) have increased nearly three times faster than population. While State population increased by 2% per year during the 1980's, VMT increased by 5% per year. During the 1980s,

Bay Area VMT growth rates averaged 3.5% per year and population growth rates averaged 1.6% per year. Bay Area growth rates projected for the future are much lower: through 2013, population is expected to grow by 1.2% per year and VMT is expected to grow by 1.7% per year.

Actions by the California Air Resources Board (see page 41) will result in even cleaner new cars over the next decade. These measures, coupled with natural turnover in the vehicle fleet, will greatly reduce motor vehicle emissions (see Table 1). Nonetheless, the Bay Area is still expected to fall short of attainment of the State ozone standard. Therefore, in addition to stationary source control measures, transportation control measures are proposed.

Overview of TCM Plan

The TCM plan for the '94 CAP is an integrated set of 19 measures designed to meet the specific conditions and needs of the Bay Area. These measures will be implemented in two phases, although certain TCMs span both phases. Phase 1 includes "reasonably available" measures that can be adopted and/or initiated in the near term, prior to the 1997 CAP. Phase 2 includes measures which are not expected to be initiated until after the CAP update (1998 and beyond), or for which State enabling legislation is necessary prior to implementation of the measure. However, Bay Area agencies are seeking the additional funding and/or legislative authority required for most of the Phase 2 measures. Figure 3 portrays the phasing of the TCM plan.

The TCM plan is best understood as a set of complementary measures that fall into several functional categories: mobility improvements, employer-based trip reduction, user incentives, revenue measures, pricing measures, traffic operations system, and implementation support measures. Brief descriptions of the TCMs are provided in Table 5. Expanded descriptions are contained in Appendix F.

Implementation Issues

Successful implementation of the TCM plan will require cooperation among many public agencies, the private sector, and the citizenry of the Bay Area. Agencies responsible for implementing the transportation control measures include MTC, ABAG, Caltrans, transit operators, cities and counties, ridesharing agencies and congestion management agencies. Table 5 identifies implementing agencies and schedules for each of the TCMs.

Recognizing that many agencies are already taking actions to help improve regional air quality, the District will strive to build on these efforts in implementing transportation control measures. The District is in the process of delegating implementation of its employer-based trip reduction rule (TCM 2) to interested local agencies that meet the delegation criteria required by the CCAA. Approximately 25 local agencies have expressed interest in delegation of the rule.

While public agencies are responsible for developing and operating the region's transportation system, the general public and the private sector are the ultimate users of the system. These groups will play a critical role in determining the success of the plan, both in their willingness to support policies to implement the plan and in their willingness to reduce motor vehicle trips in favor of enriched transportation alternatives.

FIGURE 3
TCM PLAN PHASING

1994 - 1997

Employer Based Trip Reduction

- Employer assistance programs (TCM 1)
- Trip Reduction Rule implementation (TCM 2)

Traffic Operations System

- Freeway and arterial mobility enhancement (TCM 11)
- Arterial traffic management (TCM 12)

Mobility Improvements

- Improve areawide transit (TCM 3)
- Rail extensions (TCM 4)
- Improve access to rail (TCM 5)
- Intercity rail service (TCM 6)
- Improve ferry service (TCM 7)
- HOV (carpool) lanes (TCM 8)
- Bicycle improvements (TCM 9)
- Youth transportation (TCM 10)

User Incentives

- Transit Use Incentives (TCM 13)

Implementation Support

- Local plans, policies and programs/ Indirect Source (TCM 15)
- Intermittent controls/ public education (TCM 16)
- Demonstration projects (TCM 17)

1998 and Beyond

Employer-Based Trip Reduction

- Adopt rule for employment centers (TCM 2)

Traffic Operations System

- Freeway and arterial mobility enhancement (TCM 11)
- Arterial traffic management (TCM 12)

Mobility Improvements

- Improve areawide transit (TCM 3)
- Expand new rail starts (TCM 4)
- Improve access to rail system (TCM 5)
- Intercity rail service (TCM 6)
- Improve ferry service (TCM 7)
- HOV (carpool) lanes (TCM 8)
- Bicycle improvements (TCM 9)
- Youth transportation (TCM 10)

User Incentives

- Transit use incentives (TCM 13)
- Rideshare/vanpool services and incentives (TCM 14)

Implementation Support

- Local plans, policies and programs/ Indirect Source (TCM 15)
- Intermittent controls/public education (TCM 16)
- Demonstration projects (TCM 17)

Need Legislative Authority

Revenue Measures (TCM 18)

- Gas tax increase or equivalent revenues
- CMAQ continuation
- TCI formula program

Pricing Measures (TCM 19)

- Smog fee
- Gas tax increase
- Congestion pricing
- Parking cash-out

TABLE 5
PROPOSED TRANSPORTATION CONTROL MEASURES

	DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #1 **Expand Employer Assistance Programs**	■ Provide assistance to regional and local ridesharing organizations	MTC, Caltrans, cities, counties, CMAs, BAAQMD	Ongoing, expansion with additional funds
	■ Provide assistance to employers, cities, counties: - Train employee transportation coordinators - Train city/county transportation demand management coordinators - Transportation management association start-up assistance - Telecommuting program, employee commute survey, vanpool program assistance	RIDES or another entity, CMAs, MTC, BAAQMD	Ongoing, expansion with additional funds
TCM #2 **Adopt Employer Based Trip Reduction Rule**	■ Implement regional employer-based trip reduction rule. (BAAQMD Regulation 13, Rule 1)	BAAQMD (delegation to cities and counties)	Ongoing
	■ Adopt trip reduction rule for employment centers	BAAQMD (delegation to cities and counties)	1998
TCM #3 **Improve Areawide Transit Service**	■ Increase local bus service as revenues become available	MTC, transit operators	Depends on funding
	■ Increase CalTrain service from 60 to 66 trains daily (part of Federal (TCM 19)	Peninsula JPB	Depends on funding
	■ Support transit improvements defined in MTC Regional Transportation Plan	MTC, transit operators	Depends on funding

TABLE 5 (Cont'd)
PROPOSED TRANSPORTATION CONTROL MEASURES

	PROPOSED DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #4 **Expedite & Expand Regional Rail Agreement**	■ Based on New Rail Starts Program - MTC Resolution 1876:	BART, MTC	
	- BART to Colma (Federal TCM 16)		Service 1995
	- BART to Dublin		Service in 1995
	- BART to West Pittsburg		Service in 1997
	- Fremont to South Bay Rail Connection		Depends on funding and funding agreement
	- BART to SF International Airport		Service in 2002
	■ Extend Tasman LRT (12 miles, 19 stations)	SCCTD, MTC	Service 1997 if Measure A upheld
	■ Extend CalTrain to downtown San Francisco	Peninsula JPB, MTC	Service 1998 if funding is available
TCM #5 **Improve Access to Rail & Ferries**	■ Feeder bus service to rail & ferries	Transit operators, MTC	Limited implementation ongoing, expanded implementation depends upon funding
	■ Improve bicycle access and facilities	MTC, transit operators	
	■ Private shuttles from transit stations to employment centers	Employers, TMAs, CalTrain, BART	
	■ Encourage BART and CalTrain to provide preferential parking for electric vehicles	MTC, BAAQMD	
TCM #6 **Improve Intercity Rail Service**	■ Implement new intercity rail service in Auburn-Sacramento-Oakland-San Jose corridor	Caltrans, AmTrak, MTC, Southern Pacific	Increase service from 3 round trips per day (current) to six round trips per day in 1995
TCM #7 **Improve Ferry Service**	■ Add second ferry to Vallejo-San Francisco run; make improvements to Vallejo run	City of Vallejo	Start-up 1995-96
	■ Potential new service from Port Sonoma to San Francisco	Private operator, PUC	Depends on funding
	■ Study new service from Berkeley and Richmond to San Francisco, and between SF and Oakland airports	MTC	Phase 2 (beyond 1997)

TABLE 5 (Cont'd)
PROPOSED TRANSPORTATION CONTROL MEASURES

	DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #8 **Construct Carpool/ Express Bus Lanes on Freeways**	■ Based on "2005 HOV Master Plan" which would expand existing 100 lane-miles to 480 upon completion	Caltrans, MTC	Subject to analysis of each segment, plan to be implemented over next 20 years
	■ Implement HOV support facilities--park & ride lots, special HOV ramps, express bus service	Caltrans, MTC, transit operators	Phases 1 and 2
TCM #9 **Improve Bicycle Access and Facilities**	■ Establish and maintain bicycle advisory committees in all nine Bay Area counties.	Cities, counties, MTC	Ongoing
	■ Develop comprehensive bicycle plans	Cities, counties, MTC	Ongoing
	■ Encourage transit operators to accommodate bicycles on transit vehicles	MTC, transit operators, BAAQMD	Ongoing
	■ Encourage Caltrans to accommodate bicycles on all bridges	Caltrans, MTC, BAAQMD	Depends on funding
	■ Encourage employers and developers to provide bicycle access and facilities	Cities, counties, BAAQMD	Ongoing and TCM 15
	■ Improve and expand bicycle lane system	Cities, counties, Caltrans	Depends on funding
TCM #10 **Youth Transportation**	■ Convert school buses to clean fuel vehicles	School districts, BAAQMD	Depends on funding
	■ Offer transit ride discounts to youth and students	Transit operators	Depends on funding
	■ Encourage carpooling among students with access to cars	RIDES or another entity, school districts	Phase 1 (1994 to 1997)
	■ Establish special carpool formation services for parents, students and staff at Bay Area elementary and secondary schools	RIDES or another entity	Depends on funding

TABLE 5 (Cont'd)
PROPOSED TRANSPORTATION CONTROL MEASURES

	DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #11 **Install Freeway Traffic Operations System (TOS)**	■ Define and implement traffic operations system to improve the flow of traffic on the regional transportation network. TOS includes transportation operational strategies, traffic surveillance, traffic advisory signs, incident management, ramp metering.	Caltrans, MTC, Partnership	Phase 2 (Beyond 1997)
	- Complete initial 45 mile segment of Caltrans' TOS	Caltrans	1996
	■ Continue and expand Freeway Service Patrol	Caltrans, MTC	Ongoing
TCM #12 **Improve Arterial Traffic Manage-ment**	■ Continue ongoing local signal timing programs (Federal TCM 25)	Caltrans, cities	Ongoing
	■ Study signal preemption for buses on arterials with high volume of bus traffic	Cities, transit operators, CMAs	Ongoing
	■ Expand signal timing programs (Federal TCM 24)	MTC, Caltrans, cities, CMAs	Ongoing
	■ Develop MTS Management Strategy	MTC, Caltrans, CMAs, Partnership	Phase 1 (1994 to 1997)
	■ Improve arterials for bus operations and to encourage bicycling	Caltrans, cities, CMAs	Ongoing

TABLE 5 (Cont'd)
PROPOSED TRANSPORTATION CONTROL MEASURES

	PROPOSED DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #13 **Transit Use Incentives**	■ Improve coordination between transit operators--routes, schedules, transfers, fares (Federal TCM 21)	MTC, transit operators	Ongoing-MTC has developed guidelines for fare and schedule coordination
	■ Expand marketing & distribution of transit passes and tickets:		
	- Expand Regional Transit Connection (RTC) ticket distribution through employers (Federal TCM 22)	MTC, transit operators	Ongoing
	- Implement "Commuter Check" program for employers to subsidize employee transit passes	MTC, RIDES, transit agencies, Commuter Check Corp., employers	Began in 1991
	- Set up local transportation stores to sell transit passes, distribute information	MTC, cities, counties	Depends on funding
	■ Selective fare reductions: reduce off-peak fares, develop special fares for family and tourist travel, weekend discounts, etc.	Transit operators	Depends on funding
	■ Implement transit centers identified in RTP	MTC, transit operators	Ongoing
	■ Translink on (Federal TCM 3) - AC Transit - BART, CCCTA - LAVTA - GG Transit - SF Muni	MTC, transit operators	AC Transit-1995 BART/CCCTA on-going LAVTA-1996 GG Transit-1997 SF Muni-1996
	■ Coordinated Transit Telephone Information (Federal TCM 3)	MTC	1995
TCM #14 **Improve Rideshare/ Vanpool Services and Incentives**	■ Enhance ridesharing marketing services and provide incentives to vanpool and carpool	RIDES or another entity, MTC, BAAQMD, Caltrans	Depends on funding
	■ Examine opportunities to reduce vanpool vehicle acquisition and operating costs	RIDES or another entity	Depends on funding

TABLE 5 (Cont'd)
PROPOSED TRANSPORTATION CONTROL MEASURES

	PROPOSED DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #15 **Local Clean Air Plans, Policies and Programs**	■ Encourage cities and counties to incorporate air quality beneficial policies and programs into local planning and development activities, with a particular focus on subdivision, zoning and site design measures that reduce the number and length of single-occupant automobile trips.	ABAG, BAAQMD, MTC in collaboration with cities and counties	Program began in 1994, ongoing
TCM #16 **Intermittent Control Measure / Public Education**	■ Encourage public to reduce motor vehicle use on days of predicted ozone exceedances through "Spare the Air" program. ■ Continue public education program to inform Bay Area residents about status of regional air quality, health effects of air pollution, sources of pollution, and measures that individuals and communities can take to help improve air quality.	BAAQMD BAAQMD with public outreach steering committee	Ongoing Ongoing
TCM #17 **Conduct Demonstration Projects**	■ Promote demonstration projects to develop new strategies to reduce motor vehicle emissions. Potential projects will include telecommuting and electronic toll collection.	BAAQMD, MTC	Depends on funding. Electronic Toll Collection scheduled for State bay and river bridges.
TCM #18 **Implement Revenue Measures**	■ Develop revenue measures needed to fund implementation of mobility improvement and user incentives: - Regional gas tax of $.10 - Continuation of CMAQ - Convert State Transit Capital Improvements (TCI) Program into a formula program.	BAAQMD, MTC, State Legislature State Legislature Federal Legislation State Legislature	 Depends on legislation Depends on legislation Depends on legislation

TABLE 5 (Cont'd)
PROPOSED TRANSPORTATION CONTROL MEASURES

	PROPOSED DESCRIPTION	IMPLEMENTING AGENCIES	SCHEDULE
TCM #19 **Implement Market Based Pricing Measures**	■ Measures would be based on: - "Smog Fee" - vehicle registration fee based on emissions & miles driven - Gas Tax increase - Consider expanding congestion pricing upon successful completion of Bay Bridge congestion pricing demonstration project - Encourage expansion of parking cash-out programs ■ Use revenues for transportation alternatives and equity programs	Depends on authorizing legislation and outcome of congestion pricing demonstration project	Depends on State legislation for authority

TCM Emission Reductions

In 1997, emissions reductions from transportation control measures implemented between 1994-1997 are expected to total approximately 2% (4 tons/day each) of the on-road mobile source inventory for reactive organic gases and nitrogen oxides. When fully implemented, TCMs are expected to yield up to an 18% reduction in reactive organic gases and a 15% reduction in nitrogen oxides. Based on the year 2000 inventory for these pollutants (some TCMs will not be implemented by 2000), emission reductions could range as high as 25 tons/day for each of these pollutants. The expected percentage reduction in emissions for each TCM, and the corresponding emission reductions in tons per day, are shown in Table 6.

TABLE 6

REDUCTION IN EMISSIONS FOR TCMS

TCM #		Percentage Emission Reduction				Tons/Day Emission Reduction			
		1997		2000+		1997		2000+	
		ROG	*NOx*	*ROG*	*NOx*	*ROG*	*NOx*	*ROG*	*NOx*
1	Expand Employer Assistance Programs	0.18	0.18	0.18	0.18	0.29	0.32	0.25	0.30
2	Adopt Employer Based Trip Reduction Rule	0.75	0.75	1.00	1.00	1.22	1.34	1.38	1.69
3	Improve Areawide Transit Service	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
4	Expedite & Expand Regional Rail Agreement	0.49	0.43	0.86	0.76	0.79	0.77	1.19	1.28
5	Improve Access to Rail & Ferries	0.02	0.02	0.32	0.32	0.03	0.04	0.44	0.54
6	Improve Intercity Rail Service	0.05	0.05	0.07	0.07	0.08	0.09	0.10	0.12
7	Improved Ferry Service	0.01	0.01	0.02	0.02	0.02	0.02	0.03	0.03
8	Construct Carpool/Express Bus Lanes on Freeways	0.23	0.22	0.64	0.62	0.37	0.39	0.88	1.05
9	Improve Bicycle Access / Facilities	0.01	0.01	0.03	0.03	0.02	0.02	0.04	0.05
10	Youth Transportation	0.00	0.00	0.14	0.14	0.00	0.00	0.13	0.24
11	Install Freeway Traffic Operations System (TOS)	0.42	0.35	1.82	1.45	0.68	0.62	2.51	2.45
12	Improve Arterial Traffic Mgmt	0.20	0.25	0.43	0.52	0.32	0.45	0.59	0.88
13	Transit Use Incentives	0.11	0.11	0.22	0.22	0.18	0.20	0.30	0.37
14	Improve Rideshare/ Vanpool Services and Incentives	0.00	0.00	0.02	0.02	0.00	0.00	0.03	0.03
15	Local Clean Air Plans, Policies and Programs	0.00	0.00	0.05	0.05	0.00	0.00	0.07	0.08
16	Intermittent Control Measure / Public Education	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
17	Conduct Demonstration Projects	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
18	Implement Revenue Measures	0.00	0.00	0.30	0.32	0.00	0.00	0.41	0.54
19	Implement Market Based Pricing Measures	0.00	0.00	12.3	9.0	0.00	0.00	17 0	15.2

Meeting CCAA Performance Standards

In addition to contributing toward the achievement of emission reduction requirements, TCMs are also required to achieve the transportation performance standards in the California Clean Air Act, as amended. New State requirements for cleaner fuels and improved motor vehicle emission control systems will suffice in meeting the goal of no net increase from mobile source emissions.

The CCAA calls for a substantial reduction in the rate of increase in vehicle trips and VMT. As mentioned earlier, VMT has increased at nearly three times the rate of population growth over the past twenty years. ABAG and MTC predict that demographic trends will dampen VMT and trip growth in the near future. It is expected that VMT and trips will both grow at approximately 1.7 percent per year, a significant reduction from previous rates forecasted for earlier periods.

The third CCAA transportation requirement calls for the region to achieve by 1999 an average of 1.4 persons per vehicle, including transit riders, during the commute period. MTC data show that average vehicle ridership (AVR) has been declining in the region, from 1.48 during the morning commute period in 1980 to 1.43 in 1987. The *1994 Regional Transportation Plan* shows an AVR of 1.4 in 1990 and an AVR of 1.4 in 2010. The 1999 AVR is expected to be approximately 1.4, as mandated by the CCAA for serious ozone nonattainment areas. The TCMs in the CAP are necessary to combat the downward trend in AVR.

Monitoring

Monitoring is necessary to gauge TCM implementation progress, to determine effectiveness of TCMs in reducing motor vehicle emissions, and to measure progress toward the CCAA transportation performance standards. Monitoring results are used to refine TCMs during each triennial CAP update.

MTC and the Air District have developed a TCM monitoring plan and protocol. The monitoring plan will be based on information that is regularly collected by MTC and Caltrans. For additional information, see Appendix B: Transportation Performance Standards Monitoring.

Emission Reductions

Table 7 shows the emission reductions estimated for the measures in this Plan based on present source inventory data and methodologies. These are planning estimates; actual future year emission reductions will depend upon refined inventory data, actual requirements of rules as adopted, and degree of compliance by the regulated community.

TABLE 7

PERCENTAGE RATE OF EMISSION REDUCTIONS WITH PROPOSED MEASURES

	1987 (Base Year)		1994 (With '91 CAP)		1997		2000	
	ROG	*NOx*	*ROG*	*NOx*	*ROG*	*NOx*	*ROG*	*NOx*
Baseline Emissions (tons/day)	706	621	548	545	483	510	459	486
Reduction from new controls (tons/day)	0	0	0	0	(10)	(5)	(21)	(6)
Total Emissions (tons/day)*	706	621	548	545	473	505	438	480
Annual Reduction Rate (percent)**	not applicable		3.20%	1.75%	3.30%	1.87%	2.92%	1.75%
Cumulative Reduction Rate (percent)	not applicable		22%	12%	33%	19%	38%	23%

* Total anthropogenic (man-made) emissions in the Bay Area.

** Percent per year, calculated from the 1987 base year.

Need for New Legislation

Some of the transportation measures proposed in this Plan will require new legislative authorities for successful implementation. Regional and local agencies will need to develop a coordinated legislative program for:

TCM 18 - Revenue measures to allow full implementation of other TCMs

TCM 19 - Authority for market-based TCMs

The affected agencies and other interested groups will work expeditiously to develop needed legislation, seek sponsors, and promote passage of laws to enable implementation of all of the proposed TCMs.

COST-EFFECTIVENESS ESTIMATES

Section 40922 of the CCAA requires an assessment of the cost-effectiveness of proposed control measures and a ranking of the measures. Section 40913(b) requires a determination by the District Board that the Plan is a cost-effective strategy to achieve attainment of State standards by the earliest practicable date.

Cost-effectiveness can be estimated with confidence for some measures when the source characteristics, control technology, and economic factors are well known. Lacking any of these, the estimates are less certain. Best available estimates are provided in Table 8. In some cases, where uncertainties are great, the costs are listed as "unknown."

TABLE 8
COST EFFECTIVENESS RANKINGS

Stationary and Mobile Source Measures	
Savings	B4
$1,000/ton*	B8 C4(a) C5(a)
$1,100/ton	A18
$2,000/ton	A1 A3(b) A5(b) A6(b) A7 A8 A9(b) A20 B2 D5(b)
$3,000/ton	C5(b)
$4,000/ton	A16 B1
$4,200/ton	B5
$6,000/ton	A14(a) E1
$7,000/ton	M5
$8,500/ton	C8
$10,000/ton	C1 C6
$19,000/ton	A9(a)
$25,000/ton	E3
$42,000/ton	B6
Unknown	A15 A17 A19 B7 C4(b) C7 F3 M1 M2 M3 M4
* $ per ton of ROG (NO_x for "D" measures)	
Transportation Control Measures**	
Savings to $25,000/ton ROG	TCM 1
$25,000 - $50,000/ton	TCM 12
$50,000 - $100,000/ton	TCM 11
$100,000 - $250,000/ton	TCM 2, 13
$250,000 - $500,000/ton	TCM 4, 5, 8, 10, 14
$500,000 - $1,000,000/tons	TCM 3, 6, 7, 9
Unknown or not applicable	TCM 15, 16, 17, 18, 19
** The ranking above was based on "gross" TCM costs. Net costs, after consideration of travel time savings, are significantly lower. TCMs 1, 11, and 12 would result in a net savings, if time savings are valued at $5/person-hour. For more information on travel time savings, see the detailed TCM descriptions in Appendix F.	

Transportation control measures are especially problematic for cost-effectiveness analysis for the following reasons:

- The effectiveness of TCMs depends in part upon human behavior and choices that are difficult to predict or measure.
- The costs may be large, especially if large capital investments and infrastructure improvements are involved.
- TCMs are often intended to meet several different societal goals, including congestion relief, mobility needs, and public safety requirements. Thus, it is difficult to assign a cost to the air pollution aspects alone.
- The methodology and analytical tools for TCMs are less developed than those for stationary sources.
- TCMs reduce congestion and thereby reduce travel time. There are differing opinions about the validity of reducing gross TCM costs by the value of the time savings to travelers and vehicles.
- Recognizing these factors, and consistent with ARB guidance, we list and rank TCM cost-effectiveness separately from stationary and mobile source measures.

Benefits and Costs of the Plan

A Socioeconomic Report was prepared for the 1991 CAP to identify the important economic impacts of the measures on the groups affected. The information available at that time was not adequate for complete quantification of all the benefits or all the costs. The major benefits of the CAP are health benefits, which are difficult to quantify. These include decreased health care costs, increased worker productivity, and improved quality of life.

Although the 1991 CAP Socioeconomic Report is not a complete cost-benefit analysis, it provides useful information on the impacts of the CAP on employment, business and industry, households, and local government. Major findings of the Socioeconomic Report were:

- The '91 CAP would result in a net increase in employment in the region. More specifically, while the increased business costs of stationary source controls would lead to a loss of 2,160 jobs, about 1,080 jobs were expected to be generated in industries that provide products and technology needed to comply with the control measures. Furthermore, transit-related jobs are expected to increase by 2,880 jobs. Finally, the transportation system improvements are expected to generate 25,000 construction jobs through 2001.
- The stationary source control measures will increase costs to business and industry in the region by $292 - $340 million, but would not significantly affect the regional economy. The electric and gas industry and the petroleum industry are the sectors that would be most affected by proposed stationary source control measures.

- TCMs, especially the more effective market-based measures, would impose substantial expense on the public ($3 billion per year) and on businesses ($330 million per year). Most of this expense represents transfers within the regional economy, and the expense would be partially offset by travel time savings of about $160 million for businesses and $1.6 billion for commuters. Adverse cost impacts of market-based measures would be greater if new fees are imposed before transportation alternatives are in place.

New control measures added to the '94 CAP are not expected to significantly alter the regional costs estimated for the '91 CAP.

TABLE 9

ANNUAL REGULATORY AGENDA

1995 -- REGULATORY AGENDA

- A18 Substitute Solvents used for Surface Preparation/Cleanup of Coatings
- A20 Control of Emissions from Polystyrene Manufacturing
- B1 Control of Railcar Loading
- B5 Limitations on Marine Vessel Tank Purging
- C1 Improved Pressure Relief Valves at Refineries and Chemical Plants Rule
- C5b Improved Wastewater (Oil-Water) Separators Rule
- C6b Further Control of Emissions from Wastewater Treatment at Refineries
- C8 Control of Wastewater Process Drains and Sumps
- M5 Publicly-Funded Vehicle Buy Back and Repair Program

1996 -- REGULATORY AGENDA

- B2 Improved Storage of Organic Liquids Rule
- B8 Improved Gasoline Dispensing Facility Rule
- F3 Promotion of Energy Efficiency
- M1 Mobile Source Emission Reduction Credit Programs:
  - b. Remote Sensing and Repair Program for automobile tailpipe emissions
  - c. Clean Fuel Vehicles Program
- M2 Control of Emissions from Airport Ground Support Equipment
- M3 Control of Emissions from Ground Power Systems at Airport Terminals
- M4 Low Emission Vehicle Fleet Operations

1997 -- REGULATORY AGENDA

- A1b Improved Architectural Coating Rule
- A3 Improved Aerospace Coatings Rule
- A5 Improved Surface Coating of Misc. Metal Parts and Products Rule
- A6 Improved Surface Coating of Plastic Parts and Products Rule
- A7 Improved Can and Coil Coating Rule
- A8 Improved Magnet Wire Coating Operations Rule
- B4 Further Emission Reductions From Gasoline Delivery Vehicles
- M1 Mobile Source Emission Reduction Credit Programs:
  - d. Program to Retrofit or Repower Buses or Heavy-Duty Trucks as Low Emission Vehicles

STATE AND FEDERAL PROGRAMS THAT CONTRIBUTE TO '94 CAP GOALS

There are many programs developed and implemented by other agencies at various levels of government that contribute to improving air quality. Some of the major State and federal programs that reduce air pollution are listed below. The '94 CAP recognizes and supports these programs and depends on them for progress toward attaining air quality standards. The '94 CAP also supports efforts to enhance such programs to make them more effective.

State Programs

Within the Cal/EPA, the Air Resources Board (ARB) has primary responsibility for protecting air quality in California. ARB develops control measures for motor vehicles, provides policy and guidance on transportation control measures, mandates improvements to consumer products, and works to expand use of clean fuels. The requirements of the different emission control programs administered by ARB are contained in California Air Pollution Control Laws. Collectively, sources affected by State control measures cause about two-thirds of the Bay Area's urban smog problem. Specific State programs include:

1. Consumer products
    - Anti-perspirants, deodorants and hair sprays
    - Household cleaners
    - Engine degreasers and windshield washer fluids
    - Air fresheners

2. Vehicular Air Pollution Control

    Motor Vehicle Emission Standards
    - On-road new and used motor vehicle emission standards
        - Light-duty motor vehicles
        - Medium-duty motor vehicles
        - Heavy-duty motor vehicles
    - Off-road motor emission standards
        - Off-road motorcycles
        - Off-road vehicles
        - Construction equipment
        - Farm equipment
        - Lawn, garden and utility equipment engines
        - Locomotives
        - Marine vessels
    - Motor vehicle sale requirements
        - Low Emission Vehicles (75% of all new cars sold in California by 2003)
        - Zero Emission Vehicles (10% of all new cars sold in California by 2003)

- Alternative fueled motor vehicle emission standards
- Fuel system evaporative loss control device standards and procedures
- Improved certification for alternative fuel retrofit systems

In-Use Performance Standards

- Motor vehicle inspection and maintenance (I&M) program
- Warranty and durability requirements
- "On-Board Diagnostic" systems for pollution control
- Manufacturer testing and recall programs

Motor Vehicle Fuel Specifications

- Clean fuels standards - for gasoline

  Phase I
  - Reid Vapor Pressure (RVP) limits
  - Detergent and deposit control additives
  - Leaded gasoline (eliminated January 1992)

  Phase II
  - Lower RVP limits
  - Limits on sulfur, benzene, olefin and aromatic hydrocarbon contents
  - Oxygenated gasoline program (winter only) to reduce CO
  - 90% and 50% distillation temperatures (T90 and T50)
- Clean fuels standards - for diesel
  - Sulfur content limits
  - Aromatic hydrocarbons limits

Transportation Control Measures

- Parking cash-out program

Federal Programs

Since several State ambient air quality standards are more stringent than the corresponding federal standards, the State control measures outlined above are often more stringent than corresponding federal control measures (where there are both State and federal control requirements). The District is currently required to comply with all of the federal CAA requirements associated with "moderate" ozone and carbon monoxide nonattainment areas. Specific federal programs include:

1. Motor Vehicle Emission Standards

   - Regulation of fuels
     - Wintertime oxygenates gasoline program to reduce CO
     - Benzene and heavy metals limits

- Nonroad engine and vehicle standards
- Clean-fuel vehicle standards
- Off-road vehicles less than 175 hp
- Urban bus standards

2. Aircraft emission standards

3. Inspection and Maintenance (I&M) Program requirements

4. Federal conformity requirements

The effect of adopted State and federal programs has been included in the '94 CAP emissions inventory.

In addition to federal control measures already enacted, the U.S. Environmental Protection Agency (EPA) has proposed a Federal Implementation Plan (FIP) for three federal ozone nonattainment areas: Los Angeles, Sacramento and Ventura. Certain control measures EPA has proposed may be implemented Statewide, and could lower emissions in the Bay Area. FIP measures proposed for Statewide implementation include:

- Architectural coatings
- Consumer products including aerosol paints
- Pesticides

The actual air quality impact of these measures has not been included in the Bay Area Emissions Inventory, since the FIP has not been finalized. EPA is under court order to develop a Final FIP by February, 1995.

OTHER ISSUES

The '94 CAP is a plan to reduce ambient ozone, in accordance with State law; the '94 CAP is not intended to satisfy federal air quality planning requirements. Other air quality issues of concern to the BAAQMD and to the public are summarized in this section.

Transport

The movement of air pollutants, carried by the wind, across jurisdictional boundaries is called long-range transport, or simply transport. ARB, in cooperation with air districts, is required by the CCAA to evaluate intrastate transport and to suggest mitigation for such transport.

Most violations of ambient air quality standards occur under stagnant weather conditions, when pollutant concentrations build up because emitted pollutants do not disperse either horizontally or vertically. For ozone, these conditions occur on hot, summer days, with calm air or very low wind speeds limiting horizontal dispersion, and temperature inversions in the atmosphere limiting vertical dispersion. Fortunately these conditions occur on relatively few days each year in the Bay Area. The more common circumstance is the action of prevailing winds from the ocean, particularly during daylight hours. These winds sweep through the Golden Gate and other gaps in the coastal hills, then on through the Bay Area following the complex topography of the region. Winds carry air pollutants and precursors from the emission point to downwind locations, mixing with cleaner air or new emissions along the particular trajectory. Pollutant and precursor concentrations are much lower on windy days, because emissions are dispersed through larger volumes of ambient air.

There is general agreement that pollutant transport does occur between the various air districts and air basins in California. The wind direction, and the transport direction, may well change from day to day, depending on specific weather conditions. The ARB has identified various transport couples (source and receptor areas) around the State. The Bay Area is identified as both a source and a receptor of transported pollutants.

An ARB staff report,* addressing CCAA requirements and the State ozone standard, suggested that the Bay Area has occasionally been responsible for "overwhelming" transport to three locations in adjacent air basins. This assessment was based on a few days in the past when meteorological conditions were ideal for carrying Bay Area pollutants into adjoining air basins. The three locations were Vacaville (in the broader Sacramento area), Crows Landing (in the San Joaquin Valley) and Pinnacles National Monument (in the North Central Coast area). Monitoring data for Vacaville, Crows Landing and Pinnacles National Monument indicate that while each of these receptor locations attains the national ozone standard, they occasionally exceed the more stringent State standard.

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*ARB, *Assessment and Mitigation of the Impacts of Transported Pollutants on Ozone Concentrations in California*, June 1993.

In recent years, as ozone levels have continued to decline in the Bay Area and its immediate surroundings, exceedances of the State standard have become less frequent. If this trend continues as expected, transport impacts will also decrease as the Bay Area and its neighboring regions approach attainment of the State standard.

In order to determine whether or not instances of "overwhelming" transport occur in the future, the BAAQMD, ARB and the three other affected air districts formed Transport Assessment Working Groups in early 1994. These working groups cooperate in assessing data needs, performing special-purpose monitoring, sharing data, establishing protocols for analysis, and evaluating transport impacts on an ongoing basis.

PM_{10}

There are both national and State ambient air quality standards for PM_{10} particulate matter with an aerodynamic diameter equal to or less than 10 microns. Particles less than ten microns are considered "inhalable" and thus a threat to lung function. The San Francisco Bay Area does not attain the State PM_{10} ambient air quality standard.

The California Legislature, when it passed the California Clean Air Act in 1988, recognized the relative intractability of the PM_{10} problem and excluded it from the basic planning requirements of Section 40910.

The Act did require the Air Resources Board to prepare a report to the Legislature regarding the prospect of achieving the State ambient air quality standard for PM_{10}. This report recommends a menu of actions, many of which are already in effect or are being evaluated. The report, however, does not recommend imposing a planning process, similar to that for ozone and carbon monoxide, for achievement of the standard within a certain period of time. The report states that "... the Board does not believe the State PM_{10} standards can be attained everywhere in California, and at all times, in the foreseeable future."

The CAP does not address PM_{10} attainment, although the control measures in the CAP will reduce PM_{10}. Vehicular traffic is a major source of PM_{10} emissions throughout the year, through vehicle reentrainment of road dust and dirt. Therefore, CAP measures to reduce trips and VMT will reduce PM_{10} as well. Oxides of nitrogen (NOx) emissions from vehicular and stationary source fuel combustion are precursors to nitrates, which compose a significant portion of ambient PM_{10}. Thus, the mobile source, transportation, and stationary source (NO_x) control measures in the CAP will have a beneficial effect on reducing PM_{10}. Woodburning in winter is also a major source of PM_{10} emissions, for which the BAAQMD operates a *"Don't Light Tonight"* program. Blowing dust from construction operations is also a source of PM_{10}. The BAAQMD is conducting a variety of technical studies to better understand PM_{10} in the Bay Area.

Toxic Air Contaminants

Toxic air contaminants (TACs) are of concern because these substances are either known or suspected carcinogens, or they are known or suspected to cause other non-carcinogenic health effects. The primary mechanism for the development of retrofit air toxics rules in California has been through the Toxic Air Contaminant Act, enacted in 1983. This Act provides a process for the identification of TACs and for the preparation of airborne toxic control measures (ATCMs) on a Statewide basis. To date, seven ATCMs have been adopted in California--five of these are now fully implemented in the Bay Area, reducing TACs from the following source categories: chrome plating, cooling towers, commercial and hospital sterilizers, and paving operations that use serpentine materials. The District has also accelerated the control of air toxics from existing sources by supplementing the ATCMs with rules developed locally, including those covering aeration of contaminated soil and water, and marine vessel loading.

Since 1987, new and modified sources have been evaluated for potential air toxics impacts in accordance with the District's Risk Management Policy. The goal of this program is to prevent any proposed projects from creating new air toxics problems.

The Air Toxics "Hot Spots" Information and Assessment Act (AB 2588), enacted in 1987, requires plants to prepare inventories of the air toxics emissions from their entire facility. The districts are then required to prioritize these facilities based on the quantity and toxicity of these emissions. Each facility that is put in a "high priority" category is required to prepare a comprehensive facility-wide health risk assessment. AB 2588 then requires that exposed individuals be notified of any "significant health risks" identified in the risk assessment. The first cycle of the District's "hot spots" program was completed in 1991. Out of the 129 "high priority" facilities preparing risk assessments, 30 had risks that required public notification. The number of facilities with risks over the notification levels has dropped each year since 1991 Currently, District efforts in the "hot spots" program are focused on "industry-wide" risk assessments. Industry-wide studies are currently underway for gas stations and dry cleaners

In 1991, the District adopted the Toxic Air Contaminant Reduction Plan, which established the goal of reducing emissions from the stationary sources within the District's jurisdiction to less than 50 percent of 1989 levels by 1995, on a toxicity-weighted basis. The 50 percent reduction goal was achieved a year ahead of schedule, in 1994.

In 1992, the State "hot spots" program was amended by legislation requiring facilities with significant health risks to develop plans to implement risk reduction measures that will reduce emissions from the facility to a level below the significant risk level within 5 years. The District is currently participating in a Statewide effort to develop program guidelines.

Global Warming

Global warming, or the "greenhouse effect," is an environmental concern that continues to be investigated and studied. Certain gaseous pollutants have been termed "greenhouse gases"

because of their properties and their ability to contribute to global warming. Methane and carbon dioxide are thought to be the most important of these gases. Carbon dioxide is produced from the combustion of fossil fuels. Energy conservation is the most effective and the most cost-effective way to reduce fossil fuel use. The TCMs and Measure F3 (Promotion of Energy Efficiency) contribute to the reduction of global warming.

Stratospheric Ozone

While ozone near the Earth's surface is a harmful pollutant, ozone in the stratosphere, which is 10 to 25 miles above the Earth's surface, provides a protective shield from the sun's damaging ultraviolet rays. There is a strong scientific consensus linking chlorofluorocarbons (CFCs), and other substances containing chlorine or bromine, with observed reductions in stratospheric ozone. Stratospheric ozone depletion is a global problem that requires a global solution. The worldwide production phase-out of stratospheric ozone depleting substances is viewed as the solution to the problem.

The Montreal Protocol, an international production phase-out agreement, is designed to implement this solution over an extended period of time with interim production reductions designed to ease the transition to safe alternatives. In the interim period, before the total production phase-out of ozone depleting substances can be realized, actions are being taken to minimize the release of these substances to the atmosphere. The 1990 amendments to the federal Clean Air Act codify and, in some cases, accelerate the production phase-out schedule and require EPA to promulgate national rules to minimize the release of ozone depleting substances to the atmosphere.

The CAP does not address ozone depleting substances because they are not precursors to ozone formation in the troposphere (below 35,000 feet). However, the BAAQMD Board has adopted a stratospheric (above 50,000 feet) ozone policy that is designed to reduce and minimize the release of ozone depleting substances to the atmosphere. The policy requires the elimination of exemptions from control requirements for ozone depleting substances in BAAQMD rules and requires the development of specified CFC capture and recycling rules for specified operations. Control measures contained in the CAP will be consistent with this policy.

Federal Planning Requirements

Major amendments to the federal Clean Air Act (federal Act) were signed into law on November 15, 1990. These amendments prescribe new planning requirements and attainment deadlines for areas that do not attain National Ambient Air Quality Standards (NAAQS). The NAAQS for ozone and carbon monoxide are less stringent than the State ambient air quality standards for these pollutants.

The federal Act planning and control requirements are, in some respects, similar to those contained in the California Clean Air Act (CCAA). The prescribed control requirements for ozone and carbon monoxide nonattainment areas in the federal Act are generally less stringent

than those contained in the CCAA, except for the requirements for motor vehicle inspection and maintenance and for oxygenated motor vehicle fuels. The federal Act requires an annual centralized motor vehicle inspection and maintenance program, or equivalent, for some areas and requires the sale of oxygenated gasoline during the winter months, as defined by implementing regulations.

The federal Act contains planning time frames and attainment deadlines that are significantly different from those contained in the CCAA. These time frames and deadlines also vary by pollutant and level of severity. The federal Act contains a classification system for ozone nonattainment areas that includes five different classifications with varying attainment deadlines, based upon ambient levels of ozone. The CCAA contains a classification system that includes four different ozone classifications, with attainment deadlines based upon the earliest practicable date that the area can attain the State standard.

The Bay Area has attained the NAAQS for ozone and carbon monoxide. Redesignation requests and maintenance plans for both of these pollutants have been submitted to the EPA. The Bay Area expects formal resignation to attainment for ozone in early '95 and for carbon monoxide in 1996. The proposed redesignations in no way affect CCAA planning requirements, for which the '94 CAP was developed.

APPENDIX A

DETERMINATION OF FEASIBLE MEASURES AND EXPEDITIOUS ADOPTION SCHEDULE

Areas that cannot achieve the 5% per year pollutant reduction target in the California Clean Air Act (the Act) can comply with an alternative requirement of the Act, Section 40914 (b) (2), which calls for inclusion of every feasible measure in a plan and an expeditious adoption schedule. However, neither "feasible" nor "expeditious" is defined in the Act.

Feasible Measures

Three sources of information have been useful in developing a working definition of feasible. These are: (1) common usage, (2) California Environmental Quality Act (CEQA) definitions, and (3) California Air Resources Board (ARB) guidance.

In common usage, *feasible* means capable of being done or dealt with successfully; suitable, reasonable, likely. (Webster's Ninth New Collegiate Dictionary, Merriam-Webster, 1988.)

In State law and in the CEQA guidelines, *feasible* means:

> "capable of being accomplished in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors."

This definition is also expressed in BAAQMD Regulation 2, Rule 2, Section 232.

The ARB provided guidance on the meaning of feasible through various documents, including:

- California Clean Air Act Guidance Paper #1 (ARB, August 1989), which discusses requirements for areas that cannot meet the 5% reduction target: "Simply put, the nonattainment area has to show that every reasonable and necessary step is being taken to achieve State standards by the earliest practicable date."

- California Clean Air Act Transportation Requirements Guidance (ARB, February 1990), which includes recommendations for reasonably available transportation control measures.

- List of Feasible Measures for Stationary Sources (ARB, March 19, 1991), which includes recognition of administrative and scheduling constraints.

The ARB has the responsibility to review all clean air plans and to either approve the plans or notify the appropriate district of any deficiencies (Sec. 41503).

The information sources listed above are largely compatible in terms of providing a useful definition of feasible. They were combined into the working definition of feasible for this Plan, which is as follows:

> Feasible measures are those measures which are: (1) reasonable and necessary for the San Francisco Bay Area; (2) capable of being implemented in a successful manner within a reasonable period of time, taking into account economic, environmental, legal, social, and technological factors; and (3) approved or approvable by the California Air Resources Board, based upon State law and ARB policies.

District staff periodically monitor and review regulations adopted in other California areas.

Expeditious Adoption Schedule

The BAAQMD would like to immediately adopt and implement all new control programs in order to improve air quality and protect health as quickly as possible.

In practice, District staff and the District Board of Directors must address the measures sequentially and, for each measure, take the necessary technical, administrative, and legal steps for successful implementation. It takes from six to eighteen months (and six to eighteen person-months of staff effort) to adopt a measure. The amount of time and resources required depends on the complexity, stringency, and cost of the proposed measure and upon the size, diversity, and sophistication of the regulated community. New programs for previously unregulated sources are particularly difficult.

During the past three years, the District has been able to adopt only four to five complex measures per year. Protracted adoption processes occurred with several refinery rules, for example.

ARB guidance suggests at least six plan measures per year as an expeditious schedule. **For the '94 CAP, the BAAQMD will attempt an adoption schedule of eight plan measures per year.** This effort will be in addition to other non-CAP regulatory programs related to toxics, particulate matter, and updates of existing rules. The proposed schedule will require additional time from staff and Board members, because many of the measures will result in protracted rule development and adoption procedures. Legislative efforts to allow the region to pursue market-based transportation control measures will also present a tremendous challenge for staff.

For each measure, District staff will have to gather and analyze data, identify the regulated community, prepare control proposals, prepare mailouts, hold workshops, communicate with all interested parties, refine analyses, prepare staff reports, develop delegation and/or enforcement procedures, and schedule public hearings. If additional measures are added to the regulatory schedule, staff will have to delay some originally programmed measures or seek additional resources.

The BAAQMD's sequence of adoption for the stationary source measures in the '94 CAP was determined by four primary considerations:

- Technical feasibility
- Significant ozone precursor reductions on permitted sources
- Cost-effectiveness within previously established ranges
- Add flexibility and streamline District regulations

The above considerations were prerequisites for District compliance with ARB's long-range transport mitigation regulations. These transport mitigation regulations required adoption by January 1, 1994 of measures requiring best available retrofit control technology (BARCT) on sources that account for at least 75% of the permitted stationary source inventory for ozone precursors.

Scheduling of the transportation and mobile source control measures was based primarily on availability under existing authorities and on agency resource constraints. MTC and its transportation partners have responsibility for implementing most of the TCMs. The schedule for District adoption of mobile source rules and mobile source emission credit programs calls for an intensive effort in 1996.

APPENDIX B

TRANSPORTATION PERFORMANCE STANDARDS MONITORING

This appendix addresses the monitoring system for determining the Bay Area's progress toward meeting the transportation performance standards of the California Clean Air Act (CCAA). In particular, this appendix specifically states the CCAA performance standards, provides estimates of average vehicle ridership (AVR), vehicle miles traveled (VMT) and vehicle trips in the Bay Area, describes the proposed monitoring approach for the Bay Area, and indicates the data collection schedule for monitoring compliance with the CCAA transportation performance standards.

CCAA Transportation Performance Standards

The CCAA requires that areas with a "serious" classification meet three transportation performance standards:

- Substantially reduce the rate of increase in passenger vehicle trips and miles traveled.
- Achieve an average 1.4 or more persons per passenger vehicle during weekday commute period by 1999.
- Achieve no net increase in vehicle emissions after 1997.

The third performance standard, no net increase in vehicle emissions after 1997, will be met in the Bay Area as a result of tighter motor vehicle emission controls and turnover of the motor vehicle fleet. The Bay Area emissions inventory (Table 1) estimates on-road motor vehicle emissions in 1997 for reactive organic gases and nitrogen oxides to be 162 and 178 and tons per day, respectively. Estimates of motor vehicle emissions in 2000 for reactive organic gases and nitrogen oxides are 138 tons per day and 169 tons per day, respectively. Although not essential for meeting the no net increase performance standard, transportation control measures would further reduce the total emissions from motor vehicles in the Bay Area. Compliance with this performance standard will be verified during each triennial CAP update.

The remainder of this appendix will address the first and second performance standards.

Estimates of AVR, VMT, and Trips

Average Vehicle Ridership (AVR)

The Metropolitan Transportation Commission (MTC) has projected average vehicle ridership in the Bay Area using regional travel forecasts undertaken for the *1994 Regional Transportation Plan*. These projections are shown in the table below.

Bay Area Regional Average Vehicle Ridership (AVR) 1990 - 2013	
Year	AM Peak AVR (1)
1990	1.4
1999	1.4(2)
2010	1.4
2013	1.4

(1) AM Peak Period includes the 6:30 to 8:30 a.m. period
(2) Projected through interpolation between years 1990 and 2010

As indicated by the table above, AM peak period AVR is relatively high in the Bay Area. However, the trend from years prior to 1990 had been downward as a result of shrinking household size, increasing household income and increasing auto ownership. The TCMs in the CAP are necessary to combat the downward trend in AVR.

Vehicle Miles Traveled (VMT)

MTC estimates that the Bay Area VMT growth rate averaged 3.5% per year between 1980 and 1990. During this period, the Bay Area population growth rate averaged 1.6% per year. Based on these estimates, VMT grew at 2.2 times the rate of population growth. Travel projections in the *1994 Regional Transportation Plan* show that VMT will grow 38% between 1990 and 2013: an average of 1.7% per year. The Bay Area population growth rate during this period is projected to be 1.2% per year. Based on these projections, VMT will grow at 1.4 times the rate of population growth--a significant decrease compared to the previous decade.

Vehicle Trips

Between 1980 and 1990 vehicle trips grew by approximately 2.7% per year. Travel projections in the *1994 Regional Transportation Plan* EIR show a 1.7% average annual growth in vehicle trips between 1990 and 2013. As indicated above, the Bay Area population growth rate during this period is projected to be 1.2% per year. Based on these projections, vehicle trips will grow at 1.4 times the population growth rate, compared to 1.7 times the population growth rate during the 1980 to 1990 period.

Monitoring Approach

The monitoring approach includes three elements:

- Administrative Record Tracking
- Traffic System Tracking
- Household Behavior Tracking

A multifaceted approach for cross-checking and verification is required to establish accurate baselines and to provide independent methods of confirming estimates of AVR, VMT, and vehicle trips. The central component of this approach is the household behavior survey. The household survey will provide statistically valid measures of trips and AVR.

Administrative Record Tracking includes compiling data on population, auto ownership, gasoline prices, parking prices, transit fares, transit patronage, consumer price indices, fuel consumption, and household income. These data are compiled by ABAG and MTC using census data or other sources. Trends for selected Bay Area data are shown below:

	1980	1990
Population	5,180,000	6,024,000
Vehicles per household	1.68	1.76
Transit Fares ('90 $) [1]	$0.82	$0.825
Modal Share (% transit)	11.6%	9.9%
Gasoline Prices-'90 (U.S. Avg.)	$1.87	$1.22
Avg. Household Inc.('89 $)	$44,200	$52,100

Administrative data provide confirmation and context for modeling results and results derived from survey data.

Traffic System Tracking includes the continuation and expansion of the traffic counting programs of Caltrans and local public works departments. It should also include special surveys such as license plate origin-destination surveys and vehicle occupancy counts. FHWA and Caltrans are now embarking upon a program to expand the Highway Performance Monitoring System (HPMS) to provide better statistically valid regional-level information. MTC will be working with these agencies to see how an expanded HPMS can be used by MTC .

Household Behavior Tracking involves panel surveys or repeated cross-sectional surveys of households in the Bay Area. This effort will be an extension of MTC's 1990 household travel survey. The household travel survey is generally conducted every ten years to coincide with the census and covers over 10,000 households. However, in conjunction with the Bay Area Congestion Pricing Demonstration Project, MTC plans to conduct a smaller household panel travel survey in the Spring and Fall of 1995 of up to 4,000 households. This survey will provide statistically valid estimates of vehicle trips (per household, per capita, and per vehicle) and average vehicle ridership (by trip purpose and by time of day); and time of day travel by trip purpose.

The following chart summarizes data collection for monitoring compliance with the CCAA:

CCAA Performance Standard	Data Variables	Frequency Calculated	Who will Calculate	When Reported
Reduce the rate of increase in passenger vehicle trips and miles traveled	• Vehicle Miles Traveled (VMT) • Vehicle Trips	Every two years	MTC	In conjunction with updates of the RTP. The last calculation was Spring of 1994.
Achieve an average 1.4 or more persons per passenger vehicle during weekday commute hours by 1999	• Average AM Peak Period Vehicle Ridership (AVR) • Average AM Peak Period Person Trips by mode • Average AM Peak Period Vehicle Trips.	Every two years	MTC	In conjunction with updates of the RTP. The last calculation was Spring of 1994.
Achieve no net increase in vehicle emissions after 1997	Not applicable	Not applicable	Not applicable	Vehicle emissions are projected to decline through 2010 without additional controls, due to State and federal motor vehicle emissions standards, combined with fleet turnover. This performance standard is tracked through the emissions inventory.

APPENDIX C

CALCULATION OF PERMITTED INVENTORY COVERAGE

(FOR TRANSPORT MITIGATION)

Transport mitigation requirements specify that, by no later than January 1, 1994, the CAP provide for the adoption of rules that represent Best Available Retrofit Control Technology (BARCT) for source categories that collectively amount to at least 75 percent of the 1987 reactive organic gases (ROG) and nitrogen oxides (NO_x) inventories for permitted stationary sources. As demonstrated below, the regulatory agenda advanced by the District has met this requirement.

Although the ARB provided general guidance regarding the assessment of BARCT, specific BARCT determinations have been issued for several source categories only. In the development of the CAP, the evaluation of BARCT, therefore, has largely been made by District staff, based on available information.

Table C-1 contains the 1987 annual average emissions inventory for point sources located within the District. The point source inventory represents emissions from sources contained in the District's permit data base. The total emissions of ROG and NO_x in the 1987 inventory are approximately 76 tons/day and 123 tons/day, respectively.

Since adoption of the '91 CAP, a sufficient number of BAAQMD Regulation 8 rules have been modified to meet the transport mitigation BARCT requirements. Table C-2 contains a listing of ROG emissions from point sources regulated by Regulation 8. The total 1987 ROG emissions from these sources is 64 tons/day, which represents about 84 percent of the point source inventory. Thus, the 75 percent transport mitigation requirement for ROG has been met.

For NO_x emissions, the District has adopted a comprehensive set of new retrofit control measures that meet BARCT requirements. The permitted stationary sources for BAAQMD Regulation 9 are contained in Table C-3. The total 1987 NO_x emissions from these sources is 98 tons/day, which represents about 80 percent of the point source inventory. Thus, the 75 percent transport mitigation requirement for NO_x has also been met.

TABLE C - 1

PERMITTED POINT SOURCES

Annual Average Inventory

	Base Year 1987 (*Tons/Day*) ROG	NO_x
INDUSTRIAL/COMMERCIAL PROCESSES/FACILITIES		
Petroleum Refining Processes	20.1	10.4
Chemical Manufacturing Facilities	2.4	2.5
Other Industrial/Commercial Processes/Facilities	4.6	0.4
PETROLEUM PRODUCT/SOLVENT EVAPORATION		
Petroleum Refinery Evaporation	9.5	0.0
Fuels Distribution	2.4	0.0
Other Organic Compound Evaporation	33.9	0.0
COMBUSTION - STATIONARY SOURCES		
Cogeneration	1.0	10.9
Power Plants	0.4	35.3
Oil Refinery External Combustion	0.5	33.7
Glass Melting Furnaces	0.0	4.5
Reciprocating Engines	0.4	6.2
Turbines	0.1	1.9
Other External Combustion	1.0	17.5
TOTALS	**76**	**123**

TABLE C - 2

EMISSIONS FROM PERMITTED POINT SOURCES

REGULATED BY BAAQMD REGULATION 8 RULES

BASE YEAR 1987 ANNUAL AVERAGE INVENTORY

Emissions of Reactive Organic Gases

Rule Number	Rule Title	*Tons/Day*
4	General Solvent and Surface Coating Operations	2.1
5	Storage of Organic Liquids	7.1
6	Terminals and Bulk Plants	0.3
7	Gasoline Dispensing Facilities	0.4
8	Wastewater (Oil-Water) Separators	4.2
11	Metal Container, Closure and Coil Coating	5.5
12	Paper, Fabric and Film Coating	0.4
13	Light and Medium Duty Motor Vehicle Assembly Plants	3.2
14	Surface Coating of Large Appliance and Metal Furniture	0.1
16	Solvent Cleaning Operations	4.4
17	Petroleum Dry Cleaning Operations	0.3
18	Valves and Flanges at Petroleum Refinery Complexes	9.3
19	Surface Coating of Miscellaneous Metal Parts and Products	1.1
20	Graphic Arts Printing and Coating Operations	1.3
23	Coating of Flat Wood Paneling	0.3
24	Pharmaceutical and Cosmetics Manufacturing Operations	0.0
25	Pump and Compressor Seals at Petroleum Refineries and Chemical Plants	3.3
26	Magnetic Wire Coating Operations	0.7
27	Perchlorocthylene Dry Cleaning Operations	3.3
28	Pressure Relief Valves at Petroleum Refineries and Chemical Plants	0.8
29	Aerospace Assembly and Component Coating Operations	1.0
30	Semiconductor Manufacturing Operations	1.2
31	Surface Coating of Plastic Parts and Products	0.3
32	Wood Furniture and Cabinet Coatings	0.6
33	Gasoline Bulk Terminals and Gasoline Delivery Vehicles	1.2
34	Solid Waste Disposal Sites	0.0
35	Coatings and Ink Manufacturing	1.3
36	Resin Manufacturing	0.1
37	Natural Gas and Crude Oil Production Facilities	0.0
38	Flexible and Rigid Disc Manufacturing	0.3
39	Gasoline Bulk Plants and Gasoline Delivery Vehicles	0.0
42	Large Commercial Bread Bakeries	0.8
43	Surface Coating of Marine Vessels	0.3
44	Marine Vessel Loading Terminals	3.8
45	Motor Vehicle and Mobile Equipment Coating Operations	2.9
47	Air Stripping and Soil Vapor Extraction Operations	0.3
48	Industrial Maintenance Coatings	1.3
50	Polyester Resin Operations	0.7
51	Adhesive and Sealant Products	0.1
	TOTAL	**64**

TABLE C - 3

EMISSIONS FROM PERMITTED POINT SOURCES

REGULATED BY BAAQMD REGULATION 9 RULES

BASE YEAR 1987 ANNUAL AVERAGE INVENTORY

Nitrogen Oxides Emissions

Rule Number	Rule Title	*Tons/Day*
7	Industrial, Institutional and Commercial Boilers and Heaters	11.6
8	Stationary Internal Combustion Engines	7.2
9	Stationary Gas Turbines	9.2
10	Petroleum Refinery Boilers, Heaters and Steam Generators	33.7
11	Electric Utility Boilers	31.6
12	Glass Melting Furnaces	4.5
	TOTAL	**98**

APPENDIX D

AIR QUALITY IMPROVEMENT: 1991 - 1994

The Bay Area has a comprehensive monitoring network consisting of 23 ozone monitors and 17 CO monitors. The present network provides good geographical coverage, and includes source areas, populated areas, and downwind concentration areas. The system has scored well on audits conducted by the EPA and ARB.

ARB requires that several measures of monitored air quality data be analyzed. One such measure is the "design value," a measure of peak pollutant concentrations. Other measures include population- and area-weighted exposure. Each of these measures has been computed for the Bay Area in this appendix, illustrating changes from a base period (1986-88) to the current period (1991-93).

Design Value

The rationale behind ARB's requirement that design value be calculated to illustrate air quality improvement is two-fold. It serves as a measure of worst-case exposure and it relates directly to progress in achieving the State ambient air quality standards. The Bay Area exceeds the State ozone (O_3) standard at about half of its monitoring sites. It has met the eight-hour carbon monoxide (CO) standard at every site for the last two years (1992 and 1993), and it has met the one-hour CO standard since the mid-1980s.

In general, any concentration exceeding these standards is considered a violation of a State standard. There are exceptions, however. One class is exceptional events. These are cases deemed by ARB to be beyond regulatory control, such as forest fires or dust storms. Another class is extreme concentration events. These are concentrations determined by ARB to occur less than once per year on the average.

In order to identify extreme concentration events for a particular monitoring site, ARB computes a design value based on the most recent three years of data available. A design value is an estimate of that concentration that would occur once per year on the average. Any measured concentration that exceeds this design value can be excluded as an extreme concentration event. If there were no other exceedances of the standard, then that site would comply with the standard.[1]

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[1]The national ozone and carbon monoxide standards are both similar in form to the State standards. The national ozone standard is 12 pphm but, as with the State standard, it can be exceeded once per year on the average. The only difference in form is how "on the average" is defined. The national ozone standard allows up to three exceedances in three years or, literally, one exceedance per year averaged over the most recent three years. In contrast, the State's method estimates a threshold above which anywhere from zero to five or six exceedances might be found in practice. The national carbon monoxide standard is simplest of all, allowing exactly one exceedance in any one year, no averaging involved.

Ozone Design Values And Trends

Table D-1 lists the design value estimates for the 1986-88 base period and for the 1991-93 current period. Listed, with two exceptions[2], are all BAAQMD monitoring sites in operation during the entire period. In the base period, the design value estimates ranged from 7.3 pphm for San Francisco to 14.6 pphm for Alum Rock and 14.5 for Livermore. Five BAAQMD sites met the State standard, with peak concentrations of less than 9.5 pphm.

TABLE D-1

OZONE DESIGN VALUE (DV) ESTIMATES AND TRENDS: 1986-1993

	Design Value Estimates (pphm)[a]		Annual Percentage DV Change		
Monitoring Site[b]	Base period 1986-88	Current period 1991-93	Best Estimate[c]	Lower Bound[d]	Upper Bound[d]
San Francisco	7.3	5.9	-3.8	-6.2	-1.4
Oakland	8.1	6.5	-3.9	-7.3	-0.4
Redwood City	9.6	7.3	-4.8	-7.8	-1.8
San Rafael	9.3	7.3	-4.2	-6.7	-1.7
Richmond	8.2	7.8	-1.0	-5.3	3.2
Santa Rosa	8.6	8.0	-1.4	-3.7	0.8
Hayward	12.7	8.7	-6.4	-9.4	-3.3
Sonoma	10.1	8.9	-2.2	-4.4	-0.1
Vallejo	10.9	9.3	-2.8	-5.1	-0.6
Mountain View	13.8	9.4	-6.4	-8.5	-4.3
Napa	10.7	9.6	-1.9	-4.6	0.8
Pittsburg	11.6	10.1	-2.6	-4.4	-0.7
Fairfield	11.1	10.2	-1.7	-3.9	0.6
Concord	12.7	10.5	-3.5	-5.7	-1.3
Bethel Island	11.1	10.6	-0.9	-2.5	0.7
San Jose	13.0	10.6	-3.8	-5.6	-1.9
Alum Rock	14.6	10.7	-5.3	-8.0	-2.5
Fremont	13.1	11.0	-3.2	-6.4	0.1
Gilroy	14.1	11.4	-3.8	-5.9	-1.8
Los Gatos	13.9	11.8	-3.0	-5.2	-0.9
Livermore	14.5	12.4	-2.9	-4.7	-1.1
Averages	11.4	9.4	-3.3		

a Design value estimates computed using ARB's *RECRATE* computer program. Each estimate is based on 3 years of daily high hour ozone data.

b Monitoring sites that meet the State ozone standard are shaded.

c Estimated percentage change equals $100(c\text{-}b)/(5b)$, where b is the base period design value and c is the current period design value.

d Lower and upper bounds constitute an 80% confidence interval for the best estimate. In particular, the range is the best estimate plus or minus $1.3s$, where s is the "native variability" of the estimate (aka the "within-year" standard deviation).

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[2]The San Leandro site did not provide reliable information for part of this period, so it is not included in this analysis. The San Jose - San Carlos Street site was not operating during the base period, so it was also not included in the analysis.

Currently, 10 of the 21 sites meet the State ozone standard. The third column of Table D-1 shows the annual change in design values from the base period to the current period as a percentage of the base period. In every case the values have declined, with an average annual decline of 3.3%.

Ozone concentrations vary from day to day due to "chance" variation induced by the weather. One summer day may be hot with calm wind, another summer day may be cool and windy throughout the region. Ozone concentrations vary considerably based on such weather factors, and thus design value estimates, which are based on these factors, will also vary. To assess the uncertainty in the design value trends, simulations of these weather variations were performed. The upper and lower bound columns in Table D-1 display a reasonable range for the annual percentage decrease in ambient ozone concentrations due to emissions reductions. About half of the values in the upper bound column are negative. Negative values here indicate that there is good statistical evidence that the declines are not due just to random factors such as weather fluctuations.

Carbon Monoxide Design Values And Trends

There are both 1-hour and 8-hour standards for carbon monoxide. The Bay Area has met both State and national 1-hour standards since the mid-1980s, so this section focuses exclusively on the 8-hour standard. Both the State and national 8-hour carbon monoxide standards are 9 ppm, not to be exceeded more than once a year[3]. Table D-2 lists design value estimates for both the base and current periods. In the base period, there were two sites, San Jose and Vallejo, whose design values exceeded the State standard. By the 1991-93 current period, no site's design value exceeded the standard. Thus, the 8-hour carbon monoxide standard has been met at every District site The next column of Table D-2 shows the annual percent changes in design values. In every case the estimated design value has declined.

[3]There are some technical differences. The State considers a violation of their carbon monoxide standard to have occurred if the CO concentration exceeds 9.0 ppm. The national standard records a violation only if the carbon monoxide concentration reaches 9.5 ppm because the national rules require rounding to the nearest ppm. The State determines carbon monoxide compliance similarly to ozone compliance. Namely, the State estimates a design value for each site (the value that they estimate would be exceeded once per year on average). Any carbon monoxide concentrations exceeding this value are excluded as being "extreme concentration events." If any non-excluded value still exceeds the standard, then the standard is violated. The national standard is much simpler. A monitoring site violates the standard if there is more than one exceedance in a particular year. Note that this is not the same as the ozone standard, which looks at an average of three years.

TABLE D-2

CARBON MONOXIDE DESIGN VALUE (DV) ESTIMATES AND TRENDS: 1986-1993

Monitoring Site	Design Value Estimates (ppm)		Annual Percentage DV Change 1986-88 to 1991-93		
	Base period 1986-88[a]	Current period 1991-93[a]	Best Estimate[b]	Lower Bound[c]	Upper Bound[c]
Fremont	5.1	4.2	-3.8	-5.9	-1.7
Oakland	6.0	5.2	-2.5	-5.3	0.2
Livermore	4.2	3.7	-2.4	-5.1	0.3
Pittsburg	4.8	3.6	-4.7	-6.9	-2.5
Richmond	4.2	3.5	-3.2	-5.4	-1.1
Concord	5.6	4.6	-3.4	-4.7	-2.0
Bethel Island	1.9	1.9	-0.5	-3.8	2.7
San Rafael	5.0	4.6	-1.8	-4.0	0.3
Napa	5.8	5.1	-2.6	-4.3	-0.9
SF - Ellis St.	7.8	5.9	-4.9	-7.5	-2.3
San Francisco	6.5	5.2	-3.9	-6.0	-1.8
Redwood City	5.5	5.0	-1.8	-4.5	1.0
San Jose	9.5	8.7	-1.9	-4.7	0.9
Gilroy	3.2	2.8	-2.1	-4.3	0.0
Vallejo	9.6	7.6	-4.1	-6.2	-2.0
Santa Rosa	4.7	3.7	-4.4	-6.6	-2.2
Averages	5.6	4.7	-3.0		

[a] Computed using *RECRATE* (a computer program developed by ARB).

[b] Best estimate = 100 (current period design value - base period design value)/[5(base period design value)]. Best estimates may seem to be higher or lower than the formula would otherwise indicate due to rounding of design values for presentation in this table (design value data were not rounded in actual computations).

[c] Bounds computed using 1.3 times the standard deviation from base and current period design value simulations.

Carbon monoxide varies from day to day due to "chance" variation induced by the weather. One winter may be cold and clear, another rainy. Carbon monoxide concentrations vary considerably based on such weather factors, and thus design value estimates, which are based on these factors, will also vary. Simulations using similar techniques to the ozone simulations were performed. The upper and lower bound columns display a reasonable range for the decrease in ambient carbon monoxide due to emissions reductions. About half of the values in the upper bound column are negative. Negative values here indicate that there is good statistical evidence that the declines are not due just to random factors such as weather fluctuations.

Population and Area-Weighted Exposures

Population- and area-weighted exposure calculations provide meaningful measures of air quality improvement for ozone. Techniques for calculating exposure to carbon monoxide have not been developed, and would not prove meaningful since exposure to high carbon monoxide concentrations is a more localized phenomenon.

Ozone design values provide information on worst-case exposures, but not aggregate exposure; design values do not indicate whether only a few people or many people are being exposed. Population exposure provides a better indication of the extent and severity of the ozone problem for human health. Moreover, the rate of progress in reducing average exposure can be very different from the progress in reducing peak ozone levels. In particular, small decreases in peak ozone translate into large decreases in exposure. Thus, even though the rate of improvement in reducing peak ozone values may be modest, the reduction in ozone-related health effects may be substantial.[4]

Population exposure is a summation of the exposures of all Bay Area residents to harmful ozone levels during a specified period. This analysis compares population exposure between two periods: 1986-88 and 1991-93. Area-weighted exposure is similar except that it is the summation of exposures of land areas rather than residents. The rationale for area-weighted exposures is to estimate the exposure of vegetation.

Population Exposure

Table D-3 lists estimated per capita exposures for the 1986-88 base period and the 1991-93 current period by county. Also listed are the percentage reductions in estimated exposure.

[4]When the '91 CAP was prepared, the CCAA mandated that Bay Area population exposure be reduced by 25% from 1986-88 levels by December 1994. A 1992 amendment to the CCAA removed this requirement by reclassifying the Bay Area from a "severe" to a "serious" ozone nonattainment category. Nevertheless, as shown below, the reduction in Bay Area population exposure has far exceeded the 25% target.

TABLE D-3

POPULATION EXPOSURE TO OZONE

County	Per Capita Exposure (person-pphm-hours above 9.0 pphm/total population)		Five-year Percent Decrease
	1986-88	1991-93	
Alameda	15.7	4.3	73
Contra Costa	11.1	4.7	58
Marin	0.4	0.2	50
Napa	3.4	4.0	-17
San Francisco	0.0	0.0	not applicable
San Mateo	2.4	0.3	85
Santa Clara	20.2	4.2	79
Solano[a]	9.2	4.7	49
Sonoma[a]	0.9	0.4	56
Bay Area	10.9	3.0	72

[a] Only that portion of the county within the BAAQMD jurisdiction is included.

Bay Area wide, there was an estimated decrease of 72% in exposure between the 1986-88 period and the 1991-93 period. The percentage reductions appear greatest in the South Bay counties, San Mateo and Santa Clara. These show reductions of about 80%. Santa Clara County, which had the highest estimated exposures in the 1986-88 period, shows the largest absolute drop in exposures. Alameda had the second highest exposures in 1986-88 and shows an exposure drop of 73%. Contra Costa, Marin, Solano, and Sonoma show smaller improvements, on the order of 50% to 60%. Napa has actually shown a small increase in exposure, although the per capita exposure is still lower than in four other counties.

To estimate the uncertainty in the reduction in Bay Area population exposure, ratios were computed between the simulated 1991-93 exposures and the simulated 1986-88 exposures. Roughly speaking, there is an 80% chance that the emissions-induced change in population exposure was a decrease of between 54% and 82%. The large range reflects meteorologically-induced uncertainty. Ozone values fluctuate considerably from day to day because of the weather. Exposure estimates magnify this fluctuation because they depend heavily on the highest (and most variable) ozone concentrations.

Area-Weighted Exposure

Area-weighted exposure is defined similarly to population exposure except that census tract area replaces census tract population. Thus it is the summation of the products of census tract areas (in square kilometers) and ozone excess above the standard. Table D-4 presents area-weighted exposure by county.

TABLE D-4

AREA-WEIGHTED EXPOSURE TO OZONE

	Area-Weighted Exposure[a]		Five Year Percentage Decrease
	1986-88	1991-93	
Alameda	28.6	9.0	68%
Contra Costa	16.7	7.1	57%
Marin	0.6	0.3	50%
Napa	3.8	3.1	15%
San Francisco	0.0	0.0	not applicable
San Mateo	3.5	0.5	86%
Santa Clara	26.3	7.0	73%
Solano[b]	9.2	4.7	50%
Sonoma[b]	1.4	0.7	54%
Bay Area	13.1	4.6	65%

[a] Units are km^2-pphm-hours above 9.0 pphm/km^2.
[b] Only that portion of the county within the BAAQMD jurisdiction is included.

Area-weighted exposures appear to be slightly larger, on average, than population exposures. This suggests that more of the high ozone levels within counties are occurring in less populated areas. The percentage reductions are similar, with the exception of Napa which shows a small downturn in area-weighted exposure.

The estimated decrease in District-wide exposure between the 1986-88 base period and the 1991-93 period is 65%. An 80% confidence interval for the decrease ranges from 50% to 78%. In other words, there is strong evidence that a real and substantial reduction in area exposure has taken place between 1986 and 1993.

APPENDIX E

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